THE

AMERICAN NATURALIST.

Vol. VI.—MARCH, 1872.—No. 3.

THE BREATHING PORES OF LEAVES.

BY PROF. T. D. BISCOE.*

If the outer layer or skin be stripped from the surface of the green colored parts of plants and examined under a low power of the microscope, the stomata, or breathing pores, will appear as green specks in the otherwise colorless membrane. Their object is to open and close communication between the intercellular space always existing between the individual cells, and the outer atmosphere.

The sausage-shaped cells constituting the essential part of the organ are called the pore cells. They have the power of separating from each other in the middle, thus opening a free way for the air to the interior tissues; or in certain conditions of light and moisture they approach each other so as to narrow or entirely close the slit between them. They are filled with protoplasm, chorophyl and starch granules, while all other cells of the outer surface are filled only with air and water.

Apparently with the object of placing these pore cells as free as possible from all constraint or pressure, so that they may correspond sensitively to all the changes in the atmosphere, they are at times situated on a level with the epidermis cells, sometimes raised above, at others sunk beneath this level. If the epidermis cell walls are thin and flexible the stomata will generally be found in the same surface with them: but when the epidermis walls are thick and stiff the stomata will generally be found sunk deep un-

* Abstract of a paper read at the Troy (N. Y.) Scientific Association, Dec. 18, 1871.

der the surface, or raised above it, or surrounded by a ring of smaller cells with thinner walls than the remaining epidermis cells.

Immediately under the stomata are empty spaces, of irregular form and varying size, called breathing rooms. They are in connection with, and form a part of the intercellular space which ramifies through the entire structure of most tissues.

It is an interesting question, in what way the stomata have been formed. Were the pore cells at first a pair of ordinary cells, which have gradually changed their form and contents until endowed with all the peculiar properties of their natural state? Or were they always existent in their peculiarities, only smaller as the leaf was younger? Or, have they grown out of a single cell by the process of subdivision and after growth? Do they belong to the epidermis, or to the chlorophyl bearing tissues beneath? Two examples, studied in their structure and history, will throw some light on these questions.

Gasteria verrucosa, of the aloe family shows, scattered over the surface, small, thick-walled squares with a deep cavity in the centre (Pl. 3, fig. 6). These squares fall at the junction of four cells which are distinguished from the others by the absence of the little cone in the middle. In the centre of each square, at the bottom of its cavity, can be seen a narrow slit. Various sections will show more of the structure. Pl. 3, figs 7 and 8 represent thin horizontal slices seen from below; *i.e.* inverted on the stage of the microscope. The razor in fig. 8 has passed through the pore cells, and in fig. 7 just beneath them. In fig. 7 you see, shimmering through the green pore cells, the thick-walled square which was so plain in the surface view. The vertical sections, figs. 9 and 10, show the thick outer wall of the epidermis and the little cones or protuberances seen in the middle of the cells in fig. 6. In fig. 9 it will be perceived that the opening between the pore cells is not a plain straight-walled cavity, but that the two cells project in the middle, and again by means of horns or protuberances, come nearly in contact above and below, thus making as it were, a couple of little ante-chambers before reaching the great breathing room. The striped portion under the pore cell in fig. 10 represents a thickening of the cork layer which has formed there; it lies on a little lower plane than the rest of the drawing. The square cavities above the pore cells may be called the front yards of the stomata. When you drop a little of Schultz' Iodine so-

lution on a section like fig. 9 the thick outer wall of the epidermis, especially in the outer half, turns deep brown, a color which follows down the sides of the cavity, extends as a very thin layer through the slit, and fades out on the walls of the rectangle below; the substance thus colored is cork, or of the nature of cork. The main portion of the walls of the pore cells, and all the cellular tissue underneath, become violet or purple: the reaction of cellulose. The little grains in the cavities of the pore cells are of a bright blue, betokening starch; and the granular mass of protoplasm in which these are embedded becomes yellowish brown.

In studying the development of this complex organ, we take the youngest leaf of the plant, and find on its base (the youngest portion) no trace or hint of stomata. A very little higher up we find the epidermis appearing as in fig. 1, many of the cells having built a partition across their front end cutting off about a quarter of the original cells. These small cells are distinguished from the remaining portion of the originally single cells, and from the undivided cells, by being filled full of granular protoplasm while the other cells are only partially filled with the protoplasm constituting the nucleus. These little cells, called mother cells, soon grow so as to become longer than broad, and are raised by the more rapid growth of the surrounding cells so as to leave an air space below (figs. 2 and 4). An approach to a spherical form is now made by the mother cells, and the walls of the neighboring cells are a little thickened with the deposition of cork substance giving the first trace of the thick-walled square of the ripe stomata. Next the mother cell divides by the formation of a thin partition which runs in the direction of the point of the leaf, and is perpendicular to its surface. Soon this partition thickens in the middle (fig. 3) and splits through the thickened portions to within about a fifth of each end. All further growth only effects minor changes in the form of the cells, or an increased thickening of their wall. Figs. 4, 5, and 9 show the various stages of growth in cross section, and fig. 10 in longitudinal section.

In *Tradescantia discolor* the stomata, quite different in appearance, are more readily seen from the surface. (Fig. 14.) The peculiarity of these stomata consists mainly in the structure and form of the epidermis cells immediately around them and constituting a part of the stomata apparatus. The form and arrangement of these cells are shown in figs. 16, 17, and 18. The

double lines in fig. 14 between the "help pore cells," as these four surrounding cells are called, are formed by projections of one cell over another, as shown at *a* of fig. 17, which when seen from above would show two contours to the same cell nearly in the same plan.

The development of these stomata is easily traced in the figures. The mother cell, shown in fig. 11, grows less rapidly than the surrounding epidermis cells, whose walls therefore stretch out as radii from its four corners. Thin partition walls are thrown across between these radii cutting off from these side cells new cells as shown in fig. 12; at *a* one of these side cells having been formed, and two at *b*. Almost immediately afterwards a pair of end cells are formed in a similar manner; and after this formation of the four help pore cells, the two pore cells are formed as described in the *Gasteria verrucosa*. Figs. 15, 16, and 17 show in cross sections the development of these organs, and fig. 18 shows the mature state in longitudinal section. The air spaces do not exist at first, but the unequal growth of the surrounding tissues causes tension which splits apart the walls dividing the cells, and thus forms and enlarges the air spaces; and in the same manner are formed the openings between the pore cells themselves.

The two examples described may serve as types of two classes of stomata, in one of which the pore cells are surrounded by ordinary epidermis cells, and in the other by modified cells or help pore cells. Within these two classes are to be found stomata differing from each other as variously as the leaves in the two great classes net veined and parallel veined.

EXPLANATION OF PLATE 3.

Figs. 1, 2, 3. Surface views of epidermis of *Gasteria verrucosa*, from first appearance of the mother cells of the stomata to the production of dividing wall between the two pore-cells.

Fig. 4. Cross section of same stage as No. 2.

Fig. 5. Cross section, somewhat older.

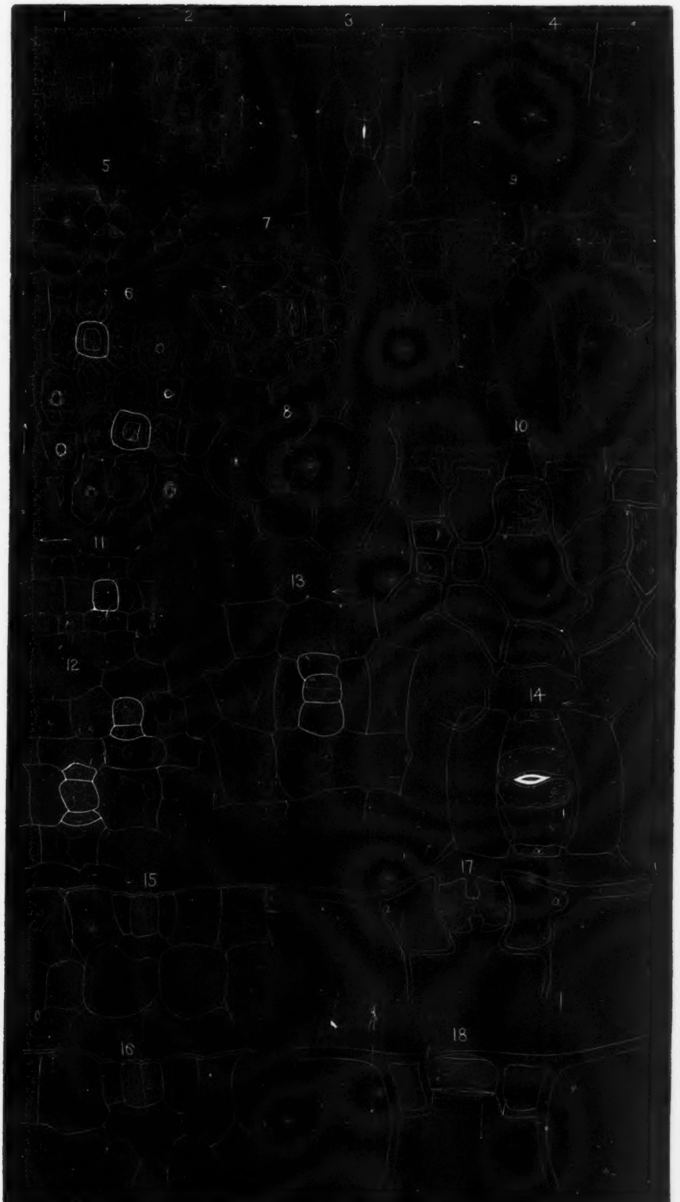
Fig. 6. Surface view of full-grown leaf, showing two stomata.

Fig. 7. Stomata fully grown seen from beneath, the plane of the drawing being completely under the stomata.

Fig. 8. Horizontal section of the same.

Fig. 9. Cross section of the same.

Fig. 10. Longitudinal section of the same.



BISCOE ON THE BREATHING PORES OF LEAVES.

Figs. 11-14. Surface views of epidermis of *Tradescantia discolor*, from first appearance of stomata to maturity of the same.
Fig. 15. Cross section of about the age of No. 12. *b*.
Fig. 16. Cross section of the age of No. 13.
Fig. 17. Cross section of full-grown.
Fig. 18. Longitudinal section of the same.
× 100. The arrows indicate the direction of the point of the leaf.

AQUEOUS PHENOMENA OF THE PRAIRIES.

BY PROF. H. W. PARKER.

THE igneous scenes of the prairies have become very common place in description. But where is there any account, either scientific or popular, of the interesting aqueous phenomena, in winter and in summer?

How it may be in the region protected on the north by the Lake Superior highlands and affected by the air of the lakes, the writer does not know, except that the temperature is much modified. But in central Iowa intense cold is of frequent occurrence, and there are conditions along with it that often bring out the splendors and wonders which we associate with arctic scenes. Parhelia, or mock suns, at morning or evening, are common; without exaggeration it may be said that they equal the real sun in brilliancy, and are indeed blinding to the sight. After witnessing them, an eastern man regards all that he has seen of this phenomenon at the east as insignificant. So likewise, mock moons, and both lunar and solar halos, crosses, and far-extending complicated circles of light, with bright spots at the intersections, may be mentioned as sights by no means unusual, and often of great magnificence and duration, continuing a good part of the day or night. The writer remembers, for example, a circle passing through the sun and reaching horizontally quite around the sky, making part of a cross inscribed within another circle around the sun, there being also four tangent circles at the ends of the cross; and this was visible for several hours before and after midday. The cloudless sky of the West conspires with spicules of frozen vaper, to render these effects not rare; for the West, at least beyond the vicinity of the lakes, is bright and sunny at all seasons.

Feathery crystals, frequently of great size and beauty, and completely clothing every exposed object, are sometimes to be seen

for a succession of mornings and would number many repetitions in the course of every winter. The writer counted a dozen fine exhibitions of this kind before one winter was half gone. In cold weather, a perceptible thin vapor comes on at night, not uncommonly, when the air has a stillness favorable to the growth of this icy leafage. In certain covered situations, where moisture rises, cobwebs are changed to a lace-work of crystals, the length and delicacy of which would be incredible to one who never lived in such a climate. In a cellar stair way, the plastering and shelf and every article on it were soon robed with a polar-bear fur of icy filaments, so long that the smaller articles lost their identity of shape.

It is well known that the fine porous soil of the West has a marvellous ability to support vegetation, during the long droughts that characterize the region. The cracking of the earth in a prolonged drought is wonderful, especially along the beaten surface of roads. Fissures over an inch across have been measured. How the subsoil can retain any moisture, with such openings down into its heart, is a mystery. On the high treeless rolling prairie, however, at the summit level between river systems, water is readily obtained at a depth of from fifteen to twenty feet, though not always in sufficient quantity. The manner in which wells are made for the supply of mills, in such a situation, is worthy of publication. A shaft is sunk, say thirty feet, and from the bottom galleries are drifted in various directions, in the style of a mine, sometimes to the length of a hundred feet. Thus, numerous very small veins are struck, which, all together, give a large supply of water. The workmen report these veins as occurring at somewhat regular intervals, and as indicated by a root-like mass of darker earth; it is affirmed, too, that they follow one general direction,—in one instance at least, said to be transverse to the surface drainage.

In this connection, reference may be made to the subterranean cryptogams that penetrate almost every inch of the deep, loamy gray clay beneath the top soil in that prairie region, and perhaps in all similar districts. This vegetation, threadlike or coarse stringlike, is coated with dark discolored earth, and is mostly dead, the thread lying shrivelled, black and loose in its cylindrical cavity; but the writer has found the filaments apparently fresh and living at a great depth — even to the depth of eight feet, if his memory is not at fault.

One very common peculiarity of the surface drainage may be

noticed — the extent to which the water of the sloughs, or swales, reaches up the acclivities on either hand, even where the interval has a very considerable descent in the line of flow; there is thus a broad concave bog that must strike a stranger with surprise, for it is not due to springs, but rather to a spongy retention of rainfall.

Some peculiarities of prairie storms should not be omitted in this sketch. Nothing at the West is done by halves; when it rains, *it rains*; and the general surface is so uniform, the soil to a certain depth so pervious, that something like a subterranean lake is suddenly formed, which rapidly rises, flooding cellars and even bursting up the cement of cellar floors by hydrostatic pressure, if cement has been resorted to. by the trustful immigrant.

One species of prairie storm should be elevated to the rank of a genus. It is mostly nocturnal in its habits and prowls all night; its distinguishing characters are surges of rain, rhythmic roar of wind like that of heavy billows on a coast, incessant quiver of lightning, and overlapping continuous peals of thunder. It is as if the spirits of the old American Mediterranean sea were claiming again their last battle-ground — a suggestion harmonizing with the ocean-like level of the country and the looming mirages of sunny days. But the lightning of this species of storm seems to be among the clouds, and the new-comer soon becomes fearless; indeed, it does not require a long residence at the West to make one familiar with lightning, however timid he may have been at the East, although it remains true that thunder gusts are not pleasant to a person who is out on the open prairie, where man or horse is the only prominent object to attract the downward or upward bolts of electricity. Finally there is something peculiarly grand in western thunder. No hills break its smooth roll, and its long crescendos and diminuendos give a breath and cadence to the sound, as if chariots could be heard rolling on for hundreds of miles over the level prairie floors.

The subjects of this article have not been in the path of the writer's special study; but he believes that the prairie region offers a fresh and interesting field of observation in this regard. The reports and books where the information might properly be looked for, have failed to give him any information in respect to the relative humidity of the prairie atmosphere — a matter of prime importance. On average winter days, the writer found it from forty to fifty hundredths of saturation.

REMARKS ON UNIFORMITY OF NOMENCLATURE IN REGARD TO MICROSCOPICAL OBJECTIVES AND OCULARS.

BY R. H. WARD, M.D.*

THE *nominal focal length* of an achromatic objective, as used by microscopists generally, represents its amplifying power as actually used in the compound microscope. Even the equivalency in amplifying power with a single lens of the same focus is no longer distinctly realized, while the size and appearance of the combination, its working focus, angular aperture, and microscopical efficiency, are not even hinted by the figures used. The nominal focus represents the magnifying power and those properties dependent on it. Like other measurements, these must be stated by comparison with known standards. To use diverse and unknown units of measurement in cases designed to be compared with each other is simply self stultification. To call two lenses, of identical magnifying power, respectively one-fourth and one-sixth inch lenses, is just as indefensible as to call two houses of equal height, forty and fifty feet high respectively. To argue against the existing looseness of usage in naming lenses, is only to state what everybody knows in regard to the advantages of uniform standards of measurement generally. So impressed are many microscopists with the urgency of this question, and so determined are they to escape from some of the present confusion, that a committee has been appointed to report on the subject. Though that committee is unprepared to report, it is believed that giving publicity to some facts and opinions involved in the consideration, may lead to useful agitation and to increased definiteness of ideas and of information in regard to it. Of course it would be premature to claim or expect accuracy of statement or safety of opinion in such a complication of disputed questions; and what is said, is designed to be contributory and suggestive, and in no degree dogmatic or final.

The great variation in objectives of identical name is familiarly

* Being the substance of remarks made by the writer at the Indianapolis meeting of the American Association for the Advancement of Science.

known and is undisputed. Among other people one-fourth of an inch is less than four-tenths and more than one-fifth; but among microscopists it may often be more than the first or less than the last. An indefinite number of figures might be published to prove or illustrate this irregularity, the writer having been particularly interested in making and recording these comparisons for more than a dozen years, and Messrs. Bicknell, Biscoe, Higgins, Cross, and many others having been especially interested in the same study; but it is idle to prove what everybody knows and admits. So familiar have some of these apparent errors become by use, and good usage too, that they have been often accepted as established, even one of the latest authorities* stating the power of the one-fourth-inch objective five times as high as that of the one-inch.

In the early days of the compound microscope as a really useful instrument, we find microscopists wishing that microscope makers would "grind their glasses to some settled standard."† We are willing to be more reasonable now, or else the conditions stated have become more difficult. We do not desire, nor consider it practicable that the opticians should make all their combinations of certain definite and conveniently graded powers: but we do propose so to name our powers, if we can, that each number shall group together all those powers of which it is the nearest and best description.

Makers would doubtless be considered as doing a favor to those who use their instruments if they would, after finishing lenses, carefully estimate their powers and name them by the fractions most nearly representing those powers. But even if this were done, and much more now when this is certainly not done, or not done upon such a uniform plan as to be satisfactory, microscopists should always reëxamine their lenses in order to be definitely informed in regard to one of their most important properties.

The easiest method of examining the *magnifying power* of an objective, by measuring the image (of a known object) which it forms at a standard distance (now ten inches), was as well understood a hundred years ago as now; a lattice of fine silver wire or of human hair, or a scale ruled on glass, being used to measure

* Suffolk, Microscopical Manipulation. London. 1870.

† Baker on Microscopes. London. 1742.

the image.* A positive ocular† or the eye-lens of a negative one is used as a simple microscope with which to read off the measurement. If a separate piece of apparatus were to be made for the purpose of measuring these powers, a positive ocular with micrometer attached would doubtless be preferred, it being placed by means of the drawtube or some other contrivance at such a height that its micrometer should be ten inches from the objective. Its reading would then give the real size of the image formed at that distance by the objective, and the ratio of this number to the known size of the object, say the distance apart of two lines on a stage micrometer, would give the magnifying power of the objective. But as few are possessed of a large variety of apparatus, or care to buy a piece for so infrequent a use as this, the measurement is generally made with an arrangement which every microscope ought to include, a negative ocular with a micrometer in the focus of its eye-lens, whose advantages for general micrometry are so well understood, giving the best view of the object and a sufficiently good view of the measuring lines, that it is usually preferred for that purpose. Of course the field lens is removed in measuring the power of the objective alone,‡ but replaced for ordinary work. If it should be thought best to name lenses by their magnifying power alone, the power ascertained could be at once attached to the lens, the present one-inch lens becoming No. 10, or x 10;§ but if it should be the usage to name it by its power when combined with some standard (say two-inch) ocular, it would be marked No. 50, or x 50, or perhaps x 45 or x 55. Should it be preferred to retain the nomenclature by inches of focal length, a power of ten diameters might be called a one-inch lens, and powers above and below rated in proportion. This plan is within reach of the opportunities of every microscopist, while the plan of actually employing a single lens of small aperture and exactly one-inch focus as a standard of comparison is only adapted to the use of

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* The measurement of the image, formed by the objective only, on a screen at a distance of several feet, as employed by Dr. J. J. Woodward at the Army Medical Museum at Washington, is unquestionably the most reliable method of determining the amplifying power; but is a method which requires too many applications and too much skill to be universally applicable.

† The convenience and growing popularity in this country of this continental term suggest the propriety of its general substitution for the awkward name eye-piece.

‡ Dr. J. J. Higgins in the American Naturalist, Dec., 1870, p. 628.

§ It might be 9 or 11, and thus the various degrees of power would be conveniently expressed.

the opticians and is not free from question as to what standard is meant after all. The lens made as a standard is probably not a one-inch lens at all (principal focus), for the principal focus is never used in the microscope; and authorities differ as to whether it should have conjugate foci of one-inch and ten inches, or ten inches apart (one-inch and nine inches). Assuming x 10 as a one-inch power, would be most easily applicable and unmistakable; and this power, ten, divided by the ascertained power of any ocular or objective would give the equivalent focal length of that objective or ocular without comparison and beyond dispute.

The chances of error in this case are the same as in ordinary micrometry, with one or two additions, and should in all cases be ascertained in order to test the reliability of any series of observations. They are due to the uncertain value of the divisions of the stage micrometer, to the like (but less important) variability of the measuring scale, to the uncertainty as to the exact optical correspondence of the lines selected for comparison in the two scales, and to the uncertainty as to obtaining exactly the assumed distance between the upper scale and a given point of the objective. The first of these errors is the largest, and its magnitude would surprise many who have noticed and admired the remarkable "perfection" of the common micrometers. A micrometer which ought to be the best in the writer's possession, with lines 100, 1000 and 2000 to the inch, has a certain error of .02 and a limit of error of .035. This is entirely too much latitude for a single source of error, and of course it is nearly eliminated by comparing a large number of spaces belonging to at least several different scales, rejecting any scales which by differing widely from the average standard are presumably erroneous, and averaging the rest. The remaining sources of error may be similarly reduced by averaging, though their aggregate limit of error, ascertained by comparing the average measurements with extreme figures beyond which there is no possibility of doubt, will be found to be very small and inconsiderable.

The standard *distance of measurement* in estimating magnifying powers may be stated to be, at present, ten inches. The distance of five inches has been recommended, even somewhat recently,* and eight,† nine,‡ and ten§ inches have been successively used.

* Brocklesby, N. Y., 1851.
† Baker, Lond., 1742.
‡ Martin Fokes, Esq., P.R.S., 1742.
§ Lardner, Carpenter, Suffolk, etc.

The smaller numbers were evidently too small, and the last, ten inches, seems to be permanently accepted as most correct theoretically and most convenient in use. If, however, the metric system were to come into general use, this distance would be changed to two hundred and fifty millimetres with increased convenience and with a scarcely appreciable difference in results. The sooner such a change is made the better, provided it is certain to come at all, and possibly it might be considered only a fair concession to the convenience of the great number of continental microscopists, and to the excellence of their metric system, to make this change without further delay.

The propriety of measuring the image at this standard distance, when estimating the power of objectives or oculars is undisputed, and it would seem equally undisputable that the whole power of the compound microscope should be obtained in the same manner, were it not that the authorities have always differed in regard to the subject. When Hooke, Griffith, Hogg, and other eminent authorities have directed that the image should be measured at the distance of the object on the stage, and Lardner, Carpenter and Suffolk, in common with most microscopists, measure the image ten inches from the eye wherever the object may be, it is useless to appeal to authorities. It would seem, however, that the former direction, to measure the image at the distance of the object, must be an advertency which could lead only to confusion. The writer has fully stated this question in a recent review,* and therefore omits further discussion of it here.

A more difficult question is as to the *point in the objective from which the measurement should be made.* If the objective had an optical centre and we could find it, there would be no difficulty in the case. But the modern objective has no permanent optical centre, at least none that we can easily find and use, and unless some one can give us a better rule, we may be obliged to measure from the bottom of the whole system, or from (about) the centre of the lowest pair or set of lenses. Mr. Charles R. Cross† has proposed to evade this difficulty by measuring ten inches between the conjugate foci used, without regard to the position of the objective; a plan which would be very eligible with high powers, but inconvenient if not inapplicable with low powers, since few compound

* The American Naturalist, June, 1871, p. 229.
† Boston, 1870.

microscopes have a body short enough to bring the conjugate foci within ten inches of each other with very low objectives, and, if they did, the magnifying power, instead of being that generally used, would be greatly reduced or altogether suppressed.

The very low power objectives (say four and five-inch) are usually mounted short in order to leave sufficient room between them and the stage, and their power as ascertained by an arbitrary rule, would be greater than that at which they are usually worked, unless, in their ordinary use, the draw tube were habitually raised enough to compensate for the shortness of their mounting.

At what point of *screw-collar adjustment* the angular aperture and the magnifying power should be computed, is one of the most complex questions involved in the discussion, and an entirely unsettled one. Most makers state the angular aperture of their lenses at its highest point, but no such uniformity of usage exists in regard to their magnifying powers.

With the lenses of a dozen years ago this would be comparatively unimportant, but with many of the high-power and high-angle lenses of the present day, the effect of the screw-collar movement is too great to be disregarded. It has been proposed, and would be most easy, always to rate objectives at their arrangement for uncovered objects, this being a naturally fixed point, and the only one at which the maker's judgment in regard to the accuracy of the correction is usually known: but this usage would greatly underrate many of the high objectives. On the other hand, rating them at their highest adjustment, or at an average between the two, might be vitiated by the fact that the point of highest correction is not a natural and fixed one, but is somewhat dependent on the judgment or caprice of the maker, some lenses of equal power being capable of a much larger range of corrections than others are. And finally, if we could agree upon some standard thickness of glass, and the glass were sufficiently uniform in refracting power, the same standard would scarcely be convenient for all powers (low powers being generally worked by the great majority of microscopists through glass, say $\frac{1}{100}$ or $\frac{1}{125}$ inch, for which many high powers are incapable of good adjustment), and few microscopists are sufficiently expert in the use of the screw-collar to make the same adjustment from the same glass-cover. Adopting the highest point of adjustment would perhaps involve the least change from present usage; and in cases of unusual interest or

importance it might be well to give both extremes, or else to specify the angle and power at which the combination was worked to accomplish the results specified. Attention need hardly be called to the fact that this great increase of power and angle, amounting sometimes to more than one-half of the minimum amount, is due entirely, not to the interposition of the cover-glass or other medium, but to the change in the relations of the lenses caused by the movement of the screw-collar. Where an extra front of different properties is added, we have essentially another objective whose power and angle should doubtless be separately stated.

The use of *linear measurement* in recording and stating powers has become so general that there may now be said to be no respectable deviation from the custom. In the early history of microscopy, powers were generally stated, according to the visible flatness or depth of the object, in superficial or cubical measure and it was plausibly urged that this represented the real, visible enlargement of the natural object; but, aside from the inconvenience of the large and often incomprehensible numbers thus obtained, this method gives in one sense the magnifying power, but in no sense the microscopical power employed. The power to see small things depends, so far as real or apparent size is concerned, on the distance from each other of minute points of structure, and this is in the exact ratio of the linear magnifying power. Squaring or cubing this power has acquired a suspicion of sensationism, if not of charlatanism, and is generally avoided in science.

If anything could be more confused and confusing than the different real and nominal powers of the objectives, it would be the corresponding powers of the *eye-pieces* or oculars. Made without any pretence of uniformity, and named without any serious attempt at significance, it has seemed until recently that no escape from the confusion was to be looked for. Yet it would seem to be convenient and altogether unobjectionable to have the oculars so named as to express their magnifying power, and the practice of doing this has been already introduced into this country. Some microscopists have re-named their oculars by their magnifying power, on the basis of one-inch to ten diameters, and I am informed by Mr. Bicknell that Tolles has already adopted the same plan, in naming those of his manufacture, discarding the letter nomenclature (A, B, C, etc.) and selecting 2 in., $1\frac{1}{2}$ in., 1 in., $\frac{3}{4}$ in., $\frac{1}{2}$ in.,

$\frac{4}{10}$ in., and $\frac{1}{4}$ in., giving powers of 5, $7\frac{1}{2}$, 10, 15, 20, 30, and 40 diameters. The writer has applied the same names to his oculars, applying the intermediate fractions $\frac{8}{10}$ in., $\frac{2}{3}$ in., and $\frac{1}{3}$ in., to intermediate powers; and he is satisfied, by experience of its convenience, that this nomenclature only needs a trial, to secure its adoption by all who use the microscope for other purposes than amusement. Of course any microscopist, having determined the power of an objective and the powers of the microscope when that objective is used with his various oculars, can obtain the powers of his oculars by dividing the latter numbers by the one first named, and can then name his oculars, like the objectives, either by their magnifying powers or by their equivalent focal lengths. The rivalry of makers and the interests of trade are not involved in this case as in that of the objectives, and there may be no reason why this plan, if as acceptable to microscopists generally, as it has been to a few, should not come into immediate use.

In order to work the objectives and oculars at their standard powers they should be of course, about ten inches apart either by length of compound body or by use of draw tube; and it is believed that most objectives whose corrections are accurate enough to show any difference will work best at about this distance. Should a decidedly different distance be used in any observations of importance, it would be well to state that fact in recording the observation.

In reviewing this subject, the following *points* would seem to be reasonably well *settled*. Objectives should be, and could be to a much greater extent than they now are, rated according to a uniform standard. They should be named not arbitrarily, but in a manner indicative of their magnifying power. Ten inches is the standard distance of measurement in estimating powers. This distance should be taken from the eye to the rule by which the measurements are made, without regard to the distance of the object on the stage. Magnifying power is always stated in linear measure. The magnifying power and angular aperture, as well as the maker's name, should be engraved on all objectives, and added to all particularly important drawings made by their means. Oculars should be named, like the objectives, in such manner as to indicate their magnifying powers or equivalent focal lengths.

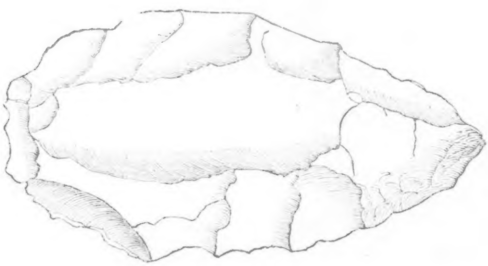
The following are some of the more important *queries* which still remain *open*. Should the standard one-inch objective be charac-

terized by magnifying ten diameters as used in the compound microscope, or should it be compared to a simple lens of actually measured focus or foci? Should the objective be named by its equivalent focal length, or by its amplifying power, or both? Should our standard distance of measurement be changed from ten inches (254 millimetres) to nine and five-sixths inches (250 millimetres)? From what point in the objective shall the distance to the scale be measured? At what point of screw-collar adjustment shall the objective be placed for rating its angular aperture and amplifying power? Should the name *ocular* be substituted for "eye-piece" in general use?

THE STONE AGE IN NEW JERSEY.

BY CHARLES C. ABBOTT, M.D.

Fig. 9.

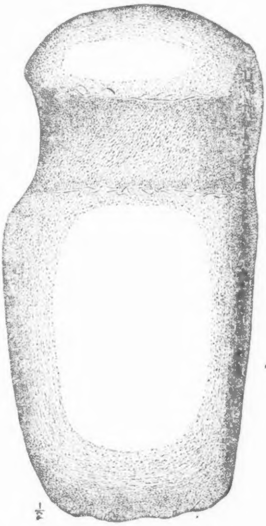


1-2 natural size.

THERE are many people still living who remember the Indians in New Jersey, the last remnant of the once mighty tribe, the Lenni Lenape; and to-day scattered all over the state, from the mountains of Sussex to the sea-beach of Cape May, are to be found stone weapons and implements, popularly considered as once the property of these aborigines, and by them fashioned in all the varied shapes, sizes and of the various minerals that we now find. Axes, arrow-heads, lance-heads, javelins, harpoons, spears, knives, scrapers, hammers, adzes, mortars and pestles, pipes, amulets and puzzling shapes of chipped jasper; all these, in varying numbers are

yearly turned up by the plough, gathered as "curiosities," or momentarily gazed upon and thrown aside to turn up again, more broken than before, and so more a puzzle to him who finds them. Again, at odd times, a "deposit" is met with, deep in the soil and a neighborhood may have the even tenor of its way disturbed by the wise comments of village sages, who ponder gravely over the "injine things" and never think to preserve them. A record of a number of these "finds," however, has put us in possession

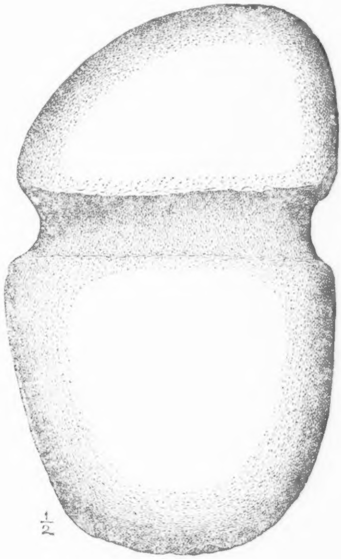
Fig. 10.



½

1-2 natural size.

Fig. 11.



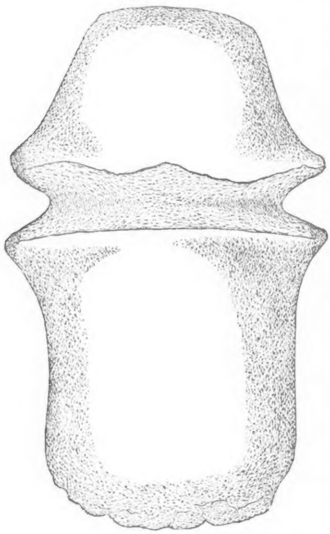
½

1-2 natural size.

of this fact, that the banks of our rivers and larger creeks were the favorite localities of these people of the stone age,—these Indians, if you choose—a people who had at no time a knowledge of metals, unless perhaps they utilized the many masses of native copper, which even a century ago were still to be found in some localities (neighborhood of New Brunswick, Middlesex and Somerset counties). There are yet savages in their stone age; and it was not many centuries ago that a people along the Delaware River fashioned from its sandstone and porphyry peb-

bles the weapons and implements their primitive wants suggested. These "relics" are now (with exceptions to be mentioned hereafter) surface-found specimens; but when a hundred or more are gathered together and carefully compared, we must come to one of two conclusions; either that there were many execrable workmen among their tool makers; or that the age of the crude specimens far exceeds that of the finely wrought relics. Compare the rude implement (Fig. 9) and the finely polished axe (Fig. 15). Both of these were found on the surface, yet we can scarcely imagine that a people who could fashion the latter, would deign to utilize the former. Take a series of whatever class of relics you may, there is always a gradation from poor (primitive) to good (elaborate), which is an indication, we believe, of a lapse of years from very ancient to more modern times, from a palæolithic to a neolithic age; and long after the introduction of metals, the choicer stone weapons were probably retained, and new ones continually manufactured. Arrow heads of stone, we know, are still in use. If this surmise be correct, if a people as rude as they who fashioned the wrought flints found at St. Acheul, near Amiens, France,* once dwelt on the shores of the Delaware, and the relics are as rude as those mentioned above, were not such a people too primitive to wander from another continent? We believe this and consider the first inhabitants along our Atlantic coast and inland to have been autochthones,† and that *their* "flint chips" are now found

Fig. 12.



1-2 natural size.

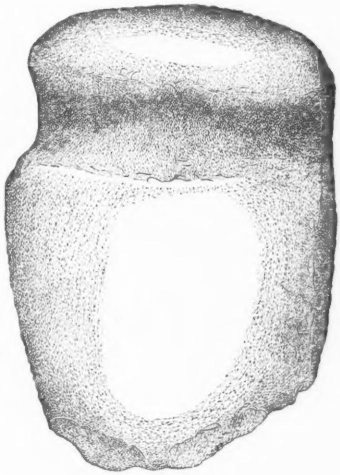
* Nilsson on the Stone Age. Edited by Sir J. Lubbock. Page xix, fig. 2. 3d Ed. 1868.

† We judge of our "Indians" by those relics that are now the only trace of their former existence, and finding stone implements as rude as those of Abbeville and Hoxne (see Lubbock's Prehistoric times), we naturally conclude that the fashioners of such "flints" were so primitive as to be incapable of a migration from Asia, and

mingled with the more elaborate stoneware of their descendants: the so-called Indians of to-day.

Having made a collection of these stone implements and weapons, it was natural to attempt to classify them at once, and when we speak of things so dissimilar as axes and arrow heads, it seems strange that there should be any doubt at times, whether any particular specimen should belong to one class or the other; yet we have met with such specimens, and our cabinet contains an unbroken series from the latter to the former, from triangular arrow heads, whose three sides scarce measure an inch, to jasper hatchets(?) a foot in length; and these hatchets run as gradually into axes, as the arrow points cease to be such, and are javelins, lance heads, harpoons or spears, as fancy dictates.

Fig. 13.

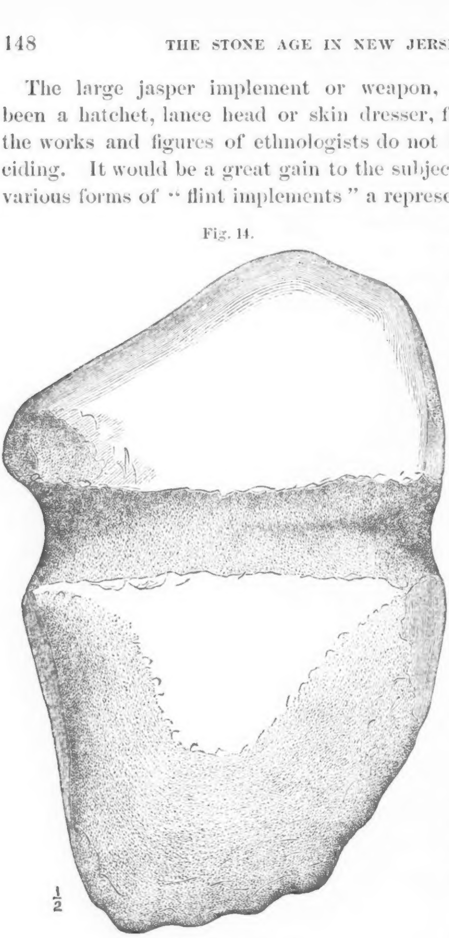


Natural size.

through a country so bleak as to offer no inducement to leave a more congenial climate. However, the Esquimaux seem to be contented where they are, but they are a very different people from the so-called "Indians." We cannot but think that there was an autochthonic people here in North America, and if an Asiatic people migrated hither, they drove away or absorbed the primitive race that utilized such rude implements, as one especially, that we have figured. We do not hesitate to state such to be our belief, notwithstanding we find Baron Bunsen saying, "The linguistic data before us [speaking of Schoolcraft's work on Indians], combined with the traditions and customs and, particularly, with the system of pictorial mnemonic writing (first revealed in this work), enable me to say that the Asiatic origin of all these tribes is as fully proved as the unity of family among themselves." Sir John Lubbock says (Origin of Civilization; Amer. ed., p. 345), "It is my belief that the great continents were already occupied by a wide spread, though sparse, population, when man was no more advanced than the lowest savages of to-day, and although I am far from believing that the various degrees of civilization which now occur can be altogether accounted for by the external circumstances as they at present exist, still these circumstances seem to me to throw much light on the very different amount of progress which has been attained by different races." That is the migration from Asia that Bunsen claimed has absorbed the preëxisting race, but has not obliterated all traces of such autochthonic people.—we say autochthonic, but if all mankind sprung from some catarrhine ape of the Old World, a migration to America must have occurred; but this is going so far back into the past, that the relative positions of continent and ocean may have been widely different from what now exists, or existed when Bunsen would date the Turanian migration from Asia.

The large jasper implement or weapon, fig. 22, may have been a hatchet, lance head or skin dresser, for that matter, and the works and figures of ethnologists do not help us much in deciding. It would be a great gain to the subject, had each of these various forms of "flint implements" a representative in the tools and weapons of some savage race now living. Such not being the case, however, conjecture must go a great way in deciding upon their use, and so suggest names by which they shall be known. With these prefatory remarks, we will now undertake a classification of the collection, upon which the remarks in this article are based; commencing with the large grooved and polished stones, popularly known as

Fig. 14.



$\frac{1}{2}$

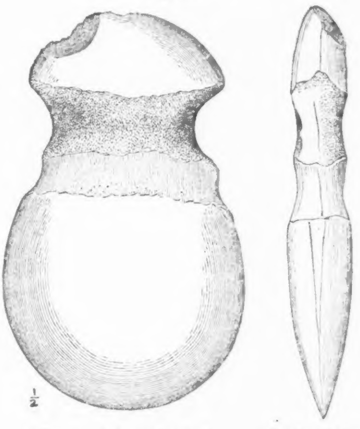
1-2 natural size.

AXES. — For convenience of description, we will separate our "axes" into two classes, axes proper and hatchets; the former being a water-worn stone that is provided with an edge and blunt back; grooved or not grooved, for a handle; and the latter being cutting implements of one or more edges; without any hammer-like part, having been always broken from a mass of flinty rock and chipped into the desired shape.

We will now again divide the axes proper into grooved and

not grooved,* and illustrate the various shapes that occur in varying numbers. A majority of the axes found in New Jersey are water-worn pebbles of sandstone, porphyry, granite, serpentine, etc., that have originally borne more or less resemblance to some one of the shapes then in use. Such cobble stones are usually grooved, on each side and beneath, and the stone worn smooth upon the upper edge (Fig. 10), which is a common shape; or the groove circles the stone (Fig. 11). In a number of specimens, the original surface of the stone has been ground or chipped away from the groove making it a more marked feature in the implement (Fig. 12). This specimen has had considerable work put upon it, as is seen by the general elegance of the outline. There is no indication of its having once been polished; and the edge, which is now mutilated, was probably never very sharp. As a rule, these cobble stone axes are not polished except upon the edge; the axe (Fig. 10) and the beautiful specimen (Fig. 15) being exceptions. In size, axes of this description vary very much, the little specimen (Fig. 13) being but three inches in length by two in breadth, and is the smallest grooved example that we have. It is of sandstone, and a repetition in outline of the more accurately made specimen (Fig. 10). On the other hand, the uncouth axe (Fig. 14) is an example of the maximum size of this style. While this specimen, unquestionably, is an axe, it is of such rude workmanship, that we can scarcely imagine any man so primitive, as to be willing to make use of it. Its greatest length

Fig. 15.

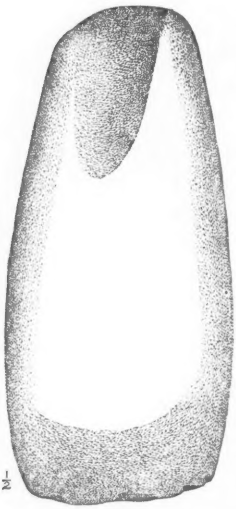


1-2 natural size (side view). 1-2 natural size (end view).

* We will not include perforated stone axes in our description. That they occur occasionally in New Jersey is probable from the fact of other perforated stones occurring, but we have never met with a specimen.

is eight inches; greatest width five inches. In thickness the stone varies little from two inches. The cutting edge has been broken off too much to determine if it was ever very sharp or not. The grooved axe (Fig. 15), found in Salem county, New Jersey, is the handsomest specimen we have ever met with. As will be seen in the drawing, it has a second slight groove or depression in front of the main one intended for the handle fastenings. The whole surface has been beautifully polished, the edge is still perfect, equidistant from each side, and describing a very nearly accurate circle. Comparing such beautiful workmanship as this with the rude axe (Fig. 14) we can scarcely believe men of the same day and generation used them both.

Fig. 16.

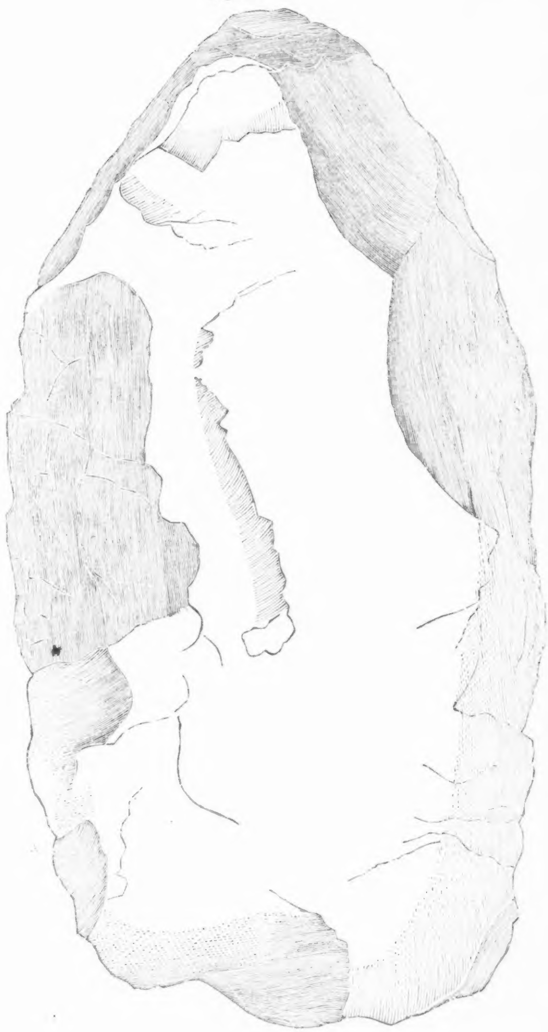


½

1-2 natural size.

We will now take up axes without grooves, and find at the outset that they are neither as numerous nor as varied in outline as the grooved, cobble stone specimens. Ungrooved axes, however, are more generally polished, have better defined edges, and usually the end opposite the cutting edge is more or less pointed. The specimen (Fig. 16) is typical of the great majority of smooth, ungrooved axes as found in New Jersey. They vary but little from this in shape or size, some few being but one half its length and the back tapered to a rather sharp point. The dimensions of this specimen are: greatest length, six inches; greatest width, scant three inches; thickness in centre, one inch and a half. Occasionally, an axe of this shape was chipped out, and the beautiful mass of many colored jasper (Fig. 17) is an illustration of this fact. Rough in outline as it unquestionably is, its intended use is unmistakable. As the chipped edge extends beyond the end, both above and below, it may be that it should have been classed as a hatchet. It forms a good connecting link between these two forms. Of small axes we have three fine specimens that present a good idea of the prevailing styles of small weapons. The axe (Fig. 18) is of por-

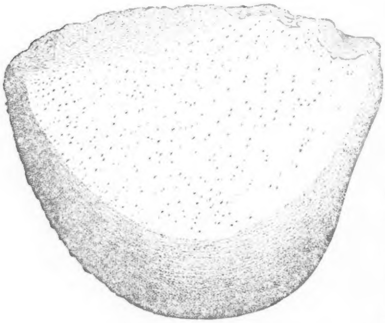
Fig. 17.



Natural size.

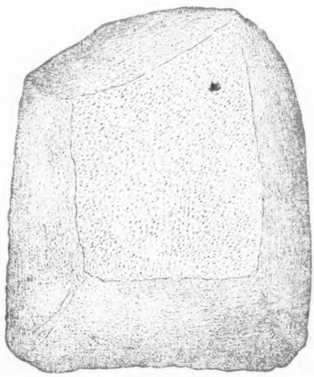
phyry, and has been very carefully chipped and ground from a water-worn pebble such as are now so very abundant in the bed and along the shores of the Delaware River, at and below Trenton, N. J. Prof. Nilsson (vide "Stone Age in Scandinavia") would call this specimen a wedge, undoubtedly, and such may have been its use. It certainly does not appear to us how a handle could have been attached to it; but its cutting edge, which has been sharp, has induced our calling it an axe. Its length is about two inches, and its breadth two and one-quarter inches; its thickness at the commencement of the polished surfaces one and three-eighths inches. Another small axe, of rare shape, is that figured next (Fig. 19). It is of a fine grained porphyritic stone and has been polished over its whole surface. Its dimensions are nearly the same as the preceding, though it is not quite as wide as the former. The cutting edge was originally good. The back has a ridge running obliquely across it, from which the surfaces slope at angles of forty-five degrees. Had this been used as a wedge for splitting wood, certainly the back is not favorably fashioned for receiving a hard blow; and the ridge, which in that case would have been much battered, in this specimen is still in moderately good state of preservation. This double faced condition of the backs of axes is not unfrequent among the

Fig. 18.



Natural size.

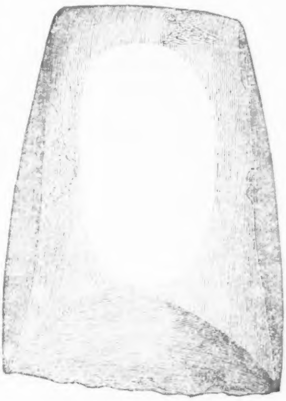
Fig. 19.



Natural size.

grooved cobble stone specimens. A third specimen of diminutive axe is that given in Fig. 20. It is of a chocolate colored slate not commonly found in use among our antiquities. It has been very carefully polished and probably had a fine edge. Its size varies little from the preceding, and its general appearance rather indicates it as an ornament, "a victory stone or charm," rather than a weapon. They are not uncommon, and sometimes occur of a somewhat smaller size. Lastly, we figure (Fig. 21) a very rude axe or that and hatchet combined. As will be seen by the illustration, it presents many points of resemblance to both a hatchet proper and a spear head. That it is not the latter, however, is evident from the fact that the base, being the natural surface of the stone, is uncut, and sufficiently broad to enable the specimen to stand upon it on a level surface. The cutting edge being on both sides and running into an obtuse point, gives some points in common with a hatchet. It is, perhaps, even more than the jasper specimen (Fig. 17), a connecting link between axes and hatchets, and to these we will now direct our attention.

Fig. 20.

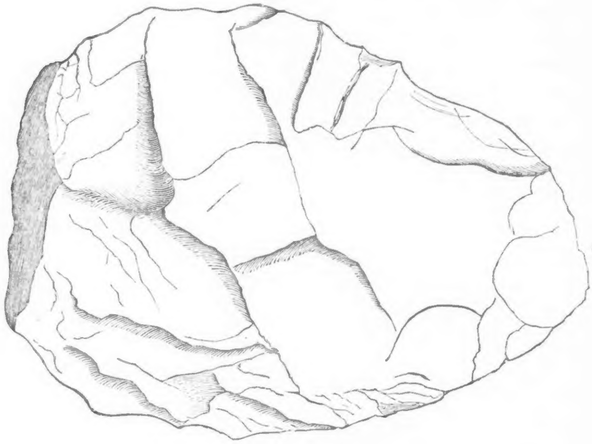


Natural size.

Hatchets.—What we here designate as hatchets, as distinguished from axes, are carefully cut jasper specimens, having no blunt edge with which to give or receive a hammer-like blow. They are usually smaller than axes and vary less in shape. Before going into details with reference to the jasper specimens, we will mention the crude hatchet (Fig. 9) and ask a comparison of it with the plate of a flint instrument given by Lubbock in Nilsson's "Stone Age." (See foregoing foot-note.) We consider this a very ancient "implement," and it is one of several that rolled out of the gravelly bluff that skirts the Delaware River near Trenton, N. J. Having no blunt edge, we call it a hatchet, and from it have in succeeding years been evolved, through accumulated skill, the more elaborate specimens. Prominently in this list stands the magnifi-

cent brown jasper specimen (Fig. 22). There we have a carefully chipped hatchet, well edged on all sides, of a nearly perfect oval outline. Its greatest width three and three-quarters inches; greatest length, six inches; and scant three-quarters of an inch in greatest thickness. This specimen is one of one hundred and fifty that were discovered in ploughing a piece of newly drained meadow near Trenton, N. J. The one figured is somewhat shorter and broader than the others, which might have been hatchets or lance heads.* They were buried points up, and were surrounded by a sufficient number of them to wall in and hold the erect ones

Fig. 21.

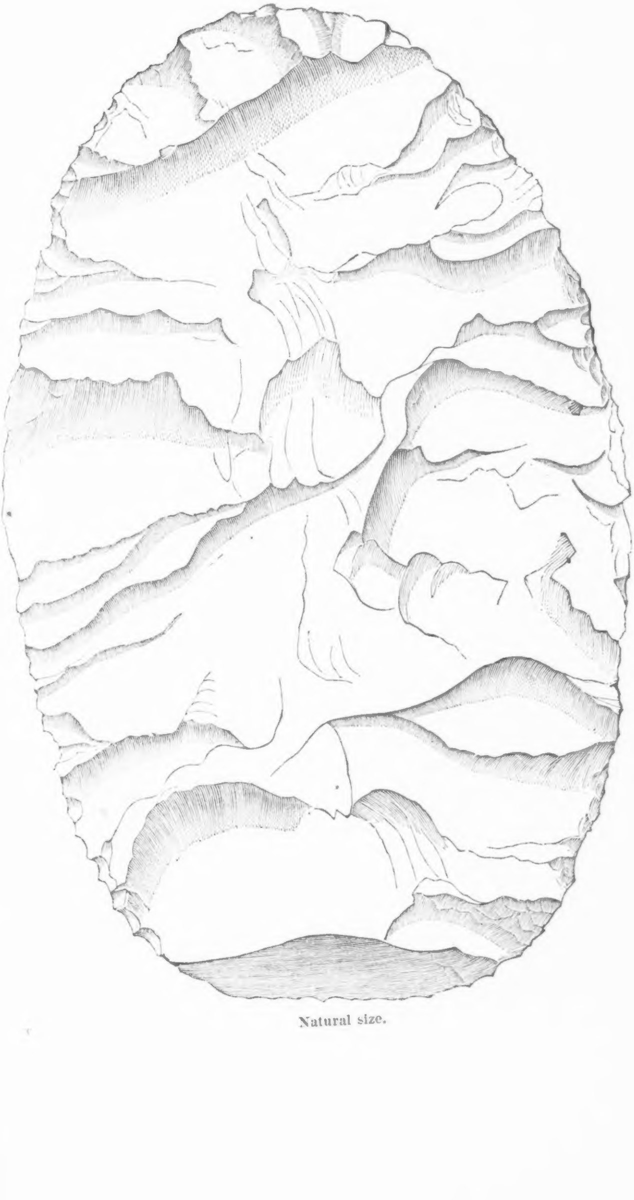


Natural size.

in position, had they been placed at the time on the surface. It is a little curious that we have as yet met with no isolated specimen similar to those in this "deposit." The bulk of the collection was presented to the Philadelphia Academy; and after many were stolen from that institution, the remainder were deposited for safe keeping with the American Philosophical Society, where they now are. Figures 23 and 24 we have also designated as hatchets, although the specimen (Fig. 24) is marvellously like the Esquimaux scraper, as figured in Sir John Lubbock's "Prehistoric Times" (3d ed., page 93, figs. 105–7), though just double the size; but

* Abbott on "Lance heads," in Proc. Acad. Nat. Sci. of Philadelphia, 1863, p. 278.

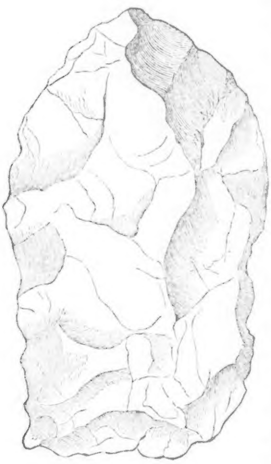
Fig. 22.



Natural size.

there is just this difference between modern or prehistoric scrapers and the implements we here designate as hatchets, *i.e.*, that the former have one flat, smooth surface, the plane of a single cleavage, the split of a single blow; while the hatchets have an edge, bevelled from each side, which are both equally well and uniformly chipped. These more elaborate "hatchets," however, may have been used as scrapers. The more usual sizes of hatchets are those illustrated by figures 25 and 26. These give the average outlines also of a series of nearly thirty gathered from one field. Their size should be no objection to the proposition that they were used as cutting tools. We have already seen that axes are equally small. Lubbock figures one from Ireland, in "Prehistoric Times," fig. 98, which is as small; and on page 182, speaking of Swiss axes, says, "with few exceptions they were small, especially when compared with the magnificent specimens from Denmark; in length they varied *from six inches to one*, while the cutting edge had generally a width of from fifteen to twenty lines;" and again on page 93, speaking of so-called "axes" or hatchets of the Kjökkenmöddings, says "they are . . . . rudely triangular or quadrangular in shape, with a cutting edge at the broader end, and two and a half to five and a half inches in length, with a breadth of one and a half to two and a half inches." Now the New Jersey specimens differ only in this, that both sides are chipped, but otherwise they are identical. As we have abundant reasons for knowing that mussels were a favorite food, they may have been used to crush their shells, having been found with heaps of half burned mussel-shells; and certainly, inserted in a handle by securely fastening the smaller or tapering end therein, they would make a formidable weapon. A tomahawk, for instance, to be worn in a belt and used in close combat, when the bow failed or the quiver of arrows was exhausted.

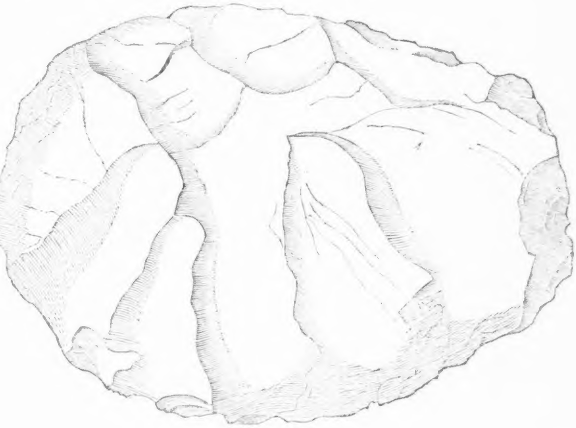
Fig. 23.



Natural size.

In conclusion we would call attention to the rude green jasper hatchet (Fig. 27), that has an edge derived from a large chip

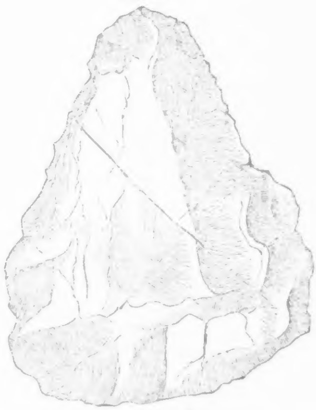
Fig. 24.



Natural size.

having been struck off, giving on one side a smooth surface, which edge meets with the opposite more gradually wrought surface. This specimen agrees more than any we have seen with the Kjökkenmödding axes: and we call attention to the similarity of our specimen with that figured in "Prehistoric Times," plate 1, fig. 8.

Fig. 25.

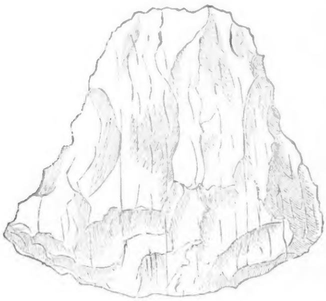


Natural size.

HAMMERS.—There are occasionally met with, lying upon the surface of our fields, slender oval stones, with a groove entirely around them, which would be good axes had they any cutting surface. Such is not the case, however, and their use as hammers is unquestionable. Such specimens are well represented by the one given in Fig. 28. This hammer is seven

inches long and about three wide. Others occur somewhat larger, but there is no other important variation. Occasionally, an unusually shaped stone will be found to have been utilized as a hammer, having required but little alteration to convert it into the required shape. Such an one is that given in (Fig. 30), ten and one-half inches in length, with a handle about one-third of its total length; it has had a sort of edge, never less than one-quarter of an inch in width, chipped upon it. The handle has been somewhat ground down, but not polished in any degree. Securely fastened to a handle, this hammer, well directed, would give an opponent a fearful blow, but we imagine they were not used as weapons, but as hammers only; and this belief is the more strengthened by the equally abundant presence of partially polished, oval cobble stones, which we believe can be best designated, considering all things, as

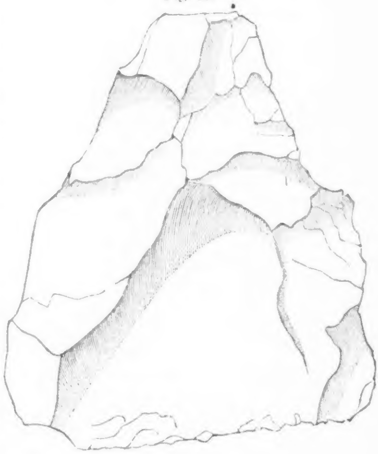
Fig. 26.



Natural size.

CHISELS. — Such a chisel is that illustrated here (Fig. 29). This specimen consists of a stone that has had a beautiful cutting edge ground at one end, and *two-thirds of one surface has been split smoothly off*, making it, not a hollow gouge, but a smooth chisel. The under surface is oval, rocking to and fro if agitated while lying on that side. A sufficient number of such specimens

Fig. 27.

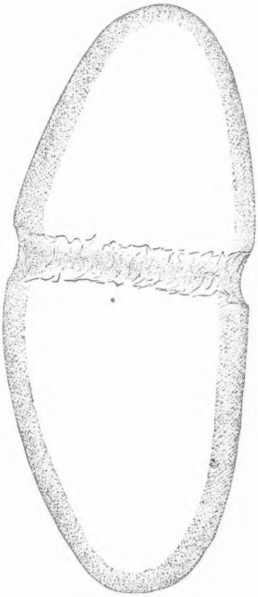


Natural size.

have been found to consider them as we have done above, rather than as adzes, hatchets or ungrooved axes.

The specimens that we have described so far have been all ordinary surface-found specimens—with one exception—and we cannot see that their use was less apparent for that fact, although a damper is thrown on one's ardor in collecting them, when Sir John Lubbock assures us that "those found singly in this manner have

Fig. 28.



1-2 natural size.

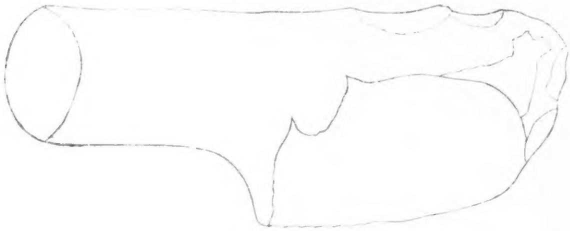
Fig. 29.

1-2 natural size.

comparatively little scientific value;" but we have not alone met with specimens thus singly found, but have met with several instances where quite large deposits of "axes" have been encountered in digging cellars and similar excavations. For what purpose this was done, nothing about "the find" gave any clue. It was only probable that for the sake of concealment from enemies or other purpose, a considerable excavation had been made and these axes therein deposited. In one case, in digging a cellar in Trenton, N. J., one-hundred and twenty were found. Again, in excavating the

"receiving vault" of the Riverview Cemetery, near Trenton, "a bushel basket full of axes were found, packed close together and six feet under ground." On the face of the bluff fronting the Delaware River below Trenton, several instances have come under the notice of the author. In the first two instances, the specimens were *all* grooved cobblestone axes. In one instance, below Trenton, the axes, over fifty, were all of porphyry, and were such as that figured above (Fig. 16). It is not a little strange that in these "finds" of axes, we have as yet invariably failed to meet with any other

Fig. 30.



1-3 natural size.

class of tools or weapons. One word as to "inscribed axes," such as that figured in "Dr. Wilson's Prehistoric Man" (2d ed. page 412, Fig. 49). When we remember that axes such as these have been for nearly two centuries (150 years at least) exposed twice yearly to the scratching of a plow, it is not strange that they should ultimately become considerably "inscribed;" and we can find a happy combination of Phœnician, Arabic, Hebraic and other letters scratched here and there over the surface of many specimens, although not with the astonishing regularity of that given in the figure above quoted of the axes from Pemberton, Burlington Co., New Jersey.— *To be continued in next number.*

REVIEWS AND BOOK NOTICES.

A NEW CATALOGUE OF BUTTERFLIES.*— More than twenty years ago Messrs Doubleday and Hewitson, in their classic work "The genera of diurnal Lepidoptera," commenced a synonymic list of

* A Synonymic Catalogue of Diurnal Lepidoptera, by W. F. Kirby, 8vo, London, 1871, pp. viii, 690.

the species of butterflies, then known attempting to refer them to the genera usually recognized, or to those established by themselves. Since that time, the number of described forms has enormously increased, while the labor of specialists has multiplied the recognized genera at a nearly corresponding rate. Such being the state of the case, a faithful attempt to reduce the chaos to more or less complete order must be welcomed by every working lepidopterist; the task is in many respects a thankless one, inasmuch as by its very nature it must soon become antiquated and no amount of supplements can prevent the absolute necessity of an entirely new catalogue in the course of one or two decades. Let us then present to Mr. Kirby the thanks of the present generation of American entomologists on the accomplishment of his undertaking.

The classification of the larger groups in the work under review is mainly that proposed not long since by Mr. Bates — one which is undoubtedly an advance upon its predecessors, but which still seems open to criticism — Mr. Kirby, however, has altered some of the names accepted by Mr. Bates, supplanting, for instance, *Erycinidæ* by *Lemoniidæ* because the *generic* name *Erycina* proves to be preoccupied. The justice of this does not seem to us manifest: and in any case they are both antedated by the name *Vestales* given to this group by Herbst as early as 1793, but which has never since been recognized.

The treatment of the genera is independent, but rather unequal, depending apparently either on the compiler's autoptical familiarity with the included species, or upon the amount of study given by naturalists generally to certain groups. He has not hesitated to make some very radical changes in nomenclature, and these appear to us almost invariably just and in strict obedience to the principles exposed in the preface; indeed it seems questionable whether he has always been sufficiently sweeping in this respect: for example: the genus *Papilio* founded by Linné for all butterflies was restricted first by Fabricius to the families *Nymphalidæ* and *Papilionidæ* of the present catalogue, and next by Schrank to the *Nymphalidæ* alone; and yet Mr. Kirby retains it in the modern sense, which has indeed the unanimous consent of entomologists, but which cannot be defended by just rules of nomenclature. This seems the more indefensible in Mr. Kirby in that he has himself pointed out this error in previous writings. No doubt

such a step would have subjected him to harsh criticism, but no doubt too it would eventually have gained acceptance and saved the generation to come from a confusion and war of words from which we still trust they may be exempt.

As the author states in his preface, there are not wanting the usual accompaniments of such a catalogue—"magazine" genera; but he has specified these and they are fortunately few in number. The species of each genus are numbered and classed according to the author's views of their affinities, certainly an undertaking very difficult of accomplishment, which only the fortunate ability of the compiler to consult the large English collections could render feasible; those which are unclassed are placed separately at the end of each group; more intimate relationships are designated by repeated numbers followed by a letter, only the first descriptions and those of iconographs are cited, excepting where a species has been described under more than one name, and the dates are invariably added; it is, however, to be regretted that the specific nomenclature commences only from the twelfth edition of the Systema Naturæ.* Regional distribution is marked in a distinct column for more ready reference.

In the appendix, corrections are made, the work is brought down to March 1871, and the author has taken the opportunity to alter some generic names. The index is very full and correct. Having already had occasion to use it some thousands of times, we have chanced to discover but one omission and no misprint whatever. The synonymic words are printed in the same type as the others but the genera are distinguished by capitals; the prime merit of the index consists in its condensation, it being printed in small type and in quadruple columns, so that each letter of the alphabet hardly averages over a page of names. As the work is one wholly of reference it will be seen how valuable is such a feature.

With regard to our own species, the author states in his preface that he has been in correspondence with American writers upon the subject, so that the catalogue is quite complete. We could point out a few errors into which he has fallen and mistakes which he has failed to correct, but since our own knowledge of the synonymy of the species and their proper generic location is by no means perfect, and even a matter of dispute among ourselves, such

* In his more recent writings, Mr. Kirby goes back to the tenth edition.

an attempt here would be a work of supererogation. It should however be stated that the author very often follows the lead of those who announce — apparently without sufficiently careful comparisons — the identity of many European and American forms; we are convinced that such instances will be hereafter shown to be exceedingly limited in number.

The work is one of great importance, and an indispensable hand-book for any entomologist engaged in the study of Butterflies. It is printed in a compact form, modelled upon a good plan and published at a reasonable price; we trust that it may compensate the compiler for the labor, vexation, and patient study which such a task required.— S. H. S.

Topographical Atlas of Massachusetts. — There has been recently published a topographical atlas of the state, which is of such a character as to demand special consideration. It was compiled by Messrs. Walling & Gray, and seems calculated to meet an existing and long-felt want.

It opens with a general view of the topography of Massachusetts, which is followed by a succinct summary of its history by Albert H. Hoyt. This summary contains a statement of some of the more important events characteristic of the period of settlement, of the colonial period, and that of the commonwealth proper, with lists of the most prominent public officers.

A rather complete history of the railways of Massachusetts is given by Edward Appleton, Railway Commissioner, while there appears in another part of the work an abstract of School Returns, including the population of each town and county, from the United States Census of 1870, followed by a list of the cities, towns, villages, post offices, railway and telegraph stations.

A rapid sketch of the geology of Massachusetts, with a revised geological map, has been furnished by Charles H. Hitchcock, Professor of Geology in Dartmouth College. This account is, in part, an epitome of the results reached by the late President Hitchcock, there being many modifications suggested to the son by more recent studies. While the classification of the rocks is by no means satisfactory to the writer, the identification of many of the beds being very questionable, and while the recognition of the Eozoon as organic is certainly premature, it should still be remembered that the geology of Massachusetts is in no wise as yet

thoroughly worked out, and that this sketch with the accompanying map will be likely to prove of great service to thousands, who may by these means gain some knowledge of the structure of this portion of the earth's surface.

A brief and accurate account of the principal vegetable forms found in the state, also a like account of its more prominent animals, might be introduced into this part of the volume, in subsequent editions, with no small advantage to the young and to all those who have not access to more purely scientific works.

The volume also contains a short sketch of the climate of Massachusetts, with a climatological map, by Lorin Blodget, author of "Climatology of the United States." This is an interesting feature of the work and is calculated to attract attention, especially in view of the marked prominence which the subject has recently assumed.

Finally, there follows a series of maps to which the several portions of the work already mentioned really serve, and properly, as an introduction. Of these maps, three are general, one being of the United States and Territories, another of New England, while the third is a railway and township map of Massachusetts. There come next maps of the several counties of the state, on a scale of two and a half miles to an inch; and last of all, maps of Boston and vicinity, and of the other principal cities in the Commonwealth.

In the construction of these maps no small expense has been incurred, and much care exercised. The compilers have availed themselves of the results of the astronomical, trigonometrical and various local surveys, and have spared no pains in their efforts to render their work deserving of confidence. While absolute correctness has not been reached and is not claimed, a fair degree of accuracy has been very generally secured. Though the maps be by no means equal to many of those recently published in Europe under government patronage, they are yet, for the ordinary purposes for which they are likely to be consulted, calculated to be almost equally useful; and while the government maps referred to are very expensive, these cost the buyer scarcely a tithe in proportion, and will be of immense practical value in rendering a better knowledge of the topography and physical features of the state possible to citizens at large.

The publication of this atlas being thus an important step in

the right direction, it is to be hoped that it will prove widely useful, in awakening and developing an intelligent interest in the geography and natural history of the state.— J. B. P.

Two Late American Papers on Ornithology.*—Mr. Ogden's article is an acceptable contribution, but like most early essays would have been the better for competent supervision. Rüppel is not the author of the Planches Enluminées, nor can we accept, even on Linnæan authority, St. Domingo as the habitat of an Asiatic bird. When geographical names are totally inept, ornithologists cancel them; *C. Dominica* (L.) should stand as *C. Brissoni* Wag., and *C. Ludoviciana* (Gm.) as *C. miles* Bodd., the latter having, moreover, priority. Without criticising the specific determinations, several of which appear to require modification, we must indicate an oversight respecting the four species Mr. Ogden has not seen. Arranging the eleven of the Academy's collection in three groups, according to the development of the wattles and carpal spines, the writer continues directly with numbers 12–15, which brings them under "*c*, species devoid of wattles" etc., which is not the case with all of them. Thus, *C. miles* is a wattled and spined species, very near if not identical with *C. personatus* Gould, which Mr. Ogden correctly locates under *a*. Some other species here admitted are probably invalid, as *C. Uralensis* Evers., which is generally assigned to *leucurus*. The term "*Lobivanellus*" is not exactly synonymous with *Chettusia*, as would seem from the title of the paper, these names being merely two of several that have been proposed for different groups of these birds. The new species is *C. nivifrons*, from "Fazoglou," belonging, as we judge from the plate, to the unwattled group.

Mr. Lawrence describes *Catherpes Sumichrasti*, apparently a second species of the genus, although, as the tail is wanting, he is not satisfied of its position. It is, he says, "rather a remarkable looking bird," with the bill shaped precisely as in *C. Mexicanus*; of stouter form and darker colors, with small white abdominal spots like the dorsal ones of that species. The type is in the Smithsonian Institution, from Vera Cruz. Three new fly-catchers are *Myiozetetes*

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*Synopsis of the genus *Chettusia* (*Lobivanellus*), with a description of a New Species. By J. A. Ogden. Pr. A. N. S. Phil., Oct. 1871. 194; pl. 1. Descriptions of New Species of birds of the families Troglodytidæ and Tyrannidæ. By Geo. N. Lawrence. Ibid. Nov. 1871, p. 233.

grandis (Tumbe, Peru, type in Vassar College), *Empidonax atrirostris* (Venezuela?, type in Cab. Lawr.) and *Myiarchus Yucatanensis.* This last is highly interesting, owing to the novel identifications it implies. It is what Mr. Lawrence in 1869 (Ann. Lyc. Nat. Hist., N. Y.) called *M.* "*Mexicanus* Kaup," whilst contending, very properly, for the distinction between his *cinerascens* and Kaup's bird. To everybody's surprise, Kaup's *Mexicana*, only lately identified, proves to be what Baird called *M. Cooperi* in 1858. This announcement of Dr. Sclater's, upon examination of Kaup's type specimen, of course makes quite a commotion in the synonymy of the several species implicated.— E. C.

BOTANY.

New Parasitic Plant of the Mistletoe Family.— Miss Millington of Glens Falls, N. Y., sends some specimens of the curious new parasite which she discovered last summer in Warren and Essex Counties, N. Y. and which have very much interested our botanists. It grows upon the branches of Black Spruce trees so abundantly that it has evidently injured, and apparently killed, some of the trees most infested by it. *Arceuthobium Oxycedri* of Bieberstein grows on juniper trees in the Caucasus region, and here and there in Southern Europe as far west as Spain. This was the only species known, and the only habitat, until Sir William Hooker brought to light American plants growing on Pine trees in the Hudson's Bay region and west to Oregon and gave a good figure in his Flora-Boreali Americana, referring it to Bieberstein's species. Mr. Nuttall, however, distinguishes this American species as *O. Americanum;* and Dr. Engelmann about twenty-five years ago distinguished two more species from the far west and south west. These plants are a sort of Mistletoe, of diminutive size, with small scales at the joints in place of leaves. They were unknown nearer to us than Hudson's Bay and the Saskatchewan on the north, and the Rocky mountains on the west, until last summer, when Mr. Peck of Albany surprised us by sending, for a name, a specimen of an *Arceuthobium* in fruit, collected by himself, if we rightly understand, in Rensselaer County, New York, inhabiting a black Spruce. Miss Millington, to whom belongs the credit of first detecting the plant, sent her specimens later. She found it in two localities and

in great abundance. "The limbs of the trees affected were very much distorted: every twig bristled with the little parasite, and some trees seem to have died from the effects of its absorption of their sap." It is curious to notice, first that a plant of this sort, growing on the boughs of Spruce trees in such quantity as to distort and even destroy them, and in three (adjacent) counties of a long and fully settled region, has been entirely overlooked, and then, when discovered, found about the same time by two independent observers at considerable distance from each other. We may now expect that it will be detected through the whole length of the Adirondacks, at least if it proves to be the same species as that of Hudson's Bay, as we think is likely. It grows, however, upon Spruce instead of Pine. The plants are diminutive, and in Dr. Engelmann's opinion, which is much to be relied on, is probably specifically distinct. So he names it *Arceuthobium minutum*. Curiously enough Mr. Elihu Hall found last summer, in Oregon, a larger *Arceuthobium* also inhabiting Spruce trees, and may therefore throw more light on the study of the New York plant. The specimens are now in the hands of the botanist most competent to this investigation, Dr. Engelmann of St. Louis.— A. Gray.

Floral Curiosity.— A friend has brought me a Fuchsia, grown in his parlor window, which exhibits one of those abnormal growths not uncommon in the vegetable world, but which I have not observed among Fuchsias. Two of the outer sepals are perfect green leaves, precisely similar to the ordinary foliage of the plant, tapering to a broad petiole and uniting at the base, with the two normal sepals, to form the tube above the germ. The rest of the flower does not differ from other blossoms. It is an interesting instance of the well understood fact that sepals and corollas are transformed leaves, or rather advanced development of leaves.— C. J. S.

E. Hall's Collection of Dried Plants of Oregon.— Mr. Elihu Hall of Illinois passed last summer in Oregon, where he was most industriously occupied in amassing a large collection of botanical specimens. These are now being arranged and named and will soon be offered to subscribers in sets, at eight dollars the one hundred specimens. The magnitude of the sets of Phænogamous and Vascular Cryptogamous plants may be rightly

estimated at from six to five hundred specimens in the fuller sets, with smaller ones as low as two hundred species. Some of these plants are new, many are rare, and indeed Oregon plants generally are scarce in all but the older herbaria of this country. So that these specimens, generally very nice and complete ones, and in limited quantity, are likely to be taken up at once. As Mr. Hall may soon leave Illinois upon another exploration, application for these collections may be addressed to Mr. Charles Wright, Harvard University Herbarium, Cambridge.—A. Gray.

Dispersion of Spores.—A. E. de Moravia mentions in "Science Gossip" a carrot-colored fungus (Peziza aurantia), about two inches broad, which when blown upon emitted a dense cloud of spores, with a distinct "fizzing" sound. Its spores were arranged in long tubes (asci) opening on the surface, but no spiral springs or other means of emission could be detected.

ZOOLOGY.

Serpents Warmed by a Lizard.—In the same glass case were two horned frogs (Phrynosoma, and really not frogs at all but lizards), and two young serpents, the milk snake and the red-bellied snake, each about ten inches long; when the sunshine left the window-sill on which the case rested, the two serpents coiled themselves together under one of the lizards, and were completely hidden by it, as if seeking protection from the chill air of the evening.—Burt G. Wilder.

Flying Spiders.—At Providence, R. I., Oct. 22, about 9 A. M., with the thermometer at 55° and a strong breeze from the south, I saw numbers of small Lycosas run up the pickets of a fence and when near the top, raise themselves as high as possible by straightening their legs, and turning their abdomen upwards. Immediately afterward some of them were blown off from the fence and carried away in a nearly horizontal direction.

One, after leaving the fence, settled to within a foot of the ground, and then moved slowly northward horizontally about twenty feet, where I lost sight of it. Another blew against me, and a thread extending upward caught on my face. Four others were blown from the fence so quickly that I could not follow them with my eyes. The spiders were about a sixth of an inch long and were probably young.

On the 19th of November, which was an unusually fine day for the season, with the thermometer about sixty degrees and a light breeze from the south-east, I saw thousands of the same little Lycosas on the tops of fences around Providence running about and every few minutes raising themselves on tip-toe with their heads to the wind and turning their abdomens up in the air. They were very easily disturbed by the near approach of any object and would either run down the fences or lay themselves down so as to be hardly visible. I succeeded however, in bringing my lens near enough to several of them while their abdomens were elevated to see the thread passing from their spinnerets. It seemed to come from the small middle pair only, but the posterior pair were in constant motion, folding together over the middle ones and then spreading apart as if to help out the thread. Occasionally, one succeeded in being blown from its position and carried along by the wind. sometimes horizontally, sometimes descending gradually as it went, but usually upward, sometimes at as high an angle as forty-five degrees from the horizon. The upper part of the thread preserved the direction which it had at starting while the lower end was drawn down in a curve by the weight of the spider. They were usually supported by one thread only, but in one instance I saw three threads passing from the spinnerets at once. In another a single thread hung down from the spider while supported by another thread in the air.

Most of the spiders hung by their spinnerets only and drew their legs close against their bodies. Others extended their legs sideways and one seemed climbing the thread as he went up.

I first noticed the spiders ascending about 10 A. M., and they continued to do so until 4 P. M., though less frequently in the afternoon.

The threads spun in their unsuccessful attempts were streaming in countless numbers from fences, trees, posts and telegraph wires, and the dried grass in a pasture looked as if covered with one great cobweb.—J. H. EMERTON.

EMBRYONIC LARVÆ OF BUTTERFLIES.—Under this head Mr. S. H. Scudder publishes an article in the "Entomologist's Monthly Magazine." He points out the probable universality of the law that caterpillars of butterflies present greater structural differences between the embryonic and adult stages of the same individual,

than are to be found in the adult larvæ of allied genera. By the term "embryonic" he designates those caterpillars which have not changed their condition since leaving the egg, a stage in which they generally continue but one or two days. Some of the changes alluded to are more or less gradual in their appearance, but they generally occur at the first moulting of the caterpillar.

He incidentally remarks that in studying caterpillars "the shape and sculpturing of the head, the form of certain segments, and especially the precise number, location and disposition of the spines, thorns, and hair-emitting warts of the body will be found to furnish abundant means of distinguishing the most closely allied and minutely subdivided genera."

The differences he proceeds to describe "are not always in the same direction; for we have seen that caterpillars which in infancy are clothed with appendages of a unique and conspicuous character, definitely disposed, display in mature life irregularly distributed, scarcely perceptible warts, emitting simple and nearly microscopic hairs; while others, which in their earliest stage bore regular series of simple hairs seated on little warts, become possessed at maturity of compound spines, surmounting mammulæ, also definitely arranged, but occupying a very different position to the hairs of early life. So, too, we find some caterpillars which bear a tuberculated irregular head in infancy, and a smooth and equal one at maturity; or the reverse, when the head is simple at birth, and heavily spined or cornute when full grown; others, again, remain almost unchanged through life. This latter condition of uniformity never applies to the appendages of the body, whether we consider their characters alone, or their disposition. Nor—the only other possible condition—do we ever find larvæ bearing only irregularly distributed, simple, minute hairs in infancy, and regularly arranged special appendages at maturity. Indeed, it is doubtful whether such a phenomenon exists in nature; since in the numerous and varied groups that have been examined, special dermal appendages have been found to be an invariable characteristic of embryonic larvæ."

Propagation of Salmon.—During the past season the first attempt to obtain eggs of the sea-going *Salmo salar* within the limits of the United States was made at Orland on the Penobscot River; and as this was also the first authenticated experiment of

confining salmon for breeding purposes through the summer and fall, it deserves some mention. It was necessary to buy live salmon of the fishermen near Bucksport in the early part of the summer, because later in the season they are scattered over the head waters of the river in the wilderness. It was found that in common brook, river, or pond water of sufficient depth and flow, the salmon would remain in perfect health from June till November. A pond specially prepared for them in a very clear, cold brook proved unsuitable, and every salmon placed there died. The seventeen fish that remained at hand in the beginning of the spawning season were kept in a pound built of stakes and nets on the margin of a large pond. The area enclosed was some fifteen or twenty square rods, and the depth of water about six feet at the deepest point. Confinement within this narrow enclosure does not appear to have hindered in the least the development of the spawn and milt. Ten out of the seventeen were found to be females and nine of them yielded eggs freely. The method of fecundation differed from that commonly employed, in that the eggs and milt were carefully kept from water until they had come in contact. This method is of Russian origin. It was in this case remarkably successful. About ninety-six per cent. of the eggs were fecundated. They were taken between the 2d and 10th of November, and on Dec. 18th they were packed up, to the number of seventy thousand, five hundred, and distributed in nearly equal proportions to the three States of Maine, Massachusetts and Connecticut.

The conditions under which the seventeen salmon were kept preclude the idea that they could obtain any considerable amount of food, and there is no good reason for thinking that they ate anything at all after they were brought from the salt water in which they were caught. They slowly fell away in flesh, and at the spawning season were very gaunt, compared with their condition in June. More noteworthy was their change in color and shape. In color they were darker, with clusters of red spots on the sides, and a general reddish tinge covered the lower parts of the body in nearly all cases. These colors and markings were dull and indistinct in the females, but were very bright in most of the males. In shape the females had undergone some change about the head, but it was not remarkable. In the males, however, the alteration was very marked. The sides were flat and broad, the back arched high, the head seemed disproportionately large, the

jaws were long and curved. At the extremity of the lower jaw was a large, curved process that shut into a cavity in the roof of the mouth. There was, indeed, between the two sexes as great a difference as there is between the male and female of our common domestic fowls. Yet in June there was so little difference that only a practised eye could distinguish the male from the female salmon. The fishermen who had been handling them all their lives had never observed the difference.

During the process of spawning and after its completion both sexes continue to fall away in flesh and soon the colors begin to fade. At the end of a month the process on the lower jaw is found to have decreased in size. Two females and one male taken from the water on the 23d of November, thirteen days after the completion of the spawning, were forwarded to the Peabody Academy of Science. To the same institution was sent another specimen, a male, that was put, early in July, into a pond of one or two hundred acres in Bucksport, and running into a brook in November, was taken thence after ten days. This was the finest specimen seen, a strong, stout-built fish thirty-four inches long and weighing eleven and a half pounds. His colors were unusually deep, perhaps in consequence of the deep reddish color of the water, through which nothing could be seen at the depth of three feet. — C. G. A.

An Ornithological Blunder. — Having submitted the case of "Bonasa Jobsii" (*Jaycox;* "Cornell Era," IV, 182) to an ornithologist, requesting him to pass upon it, we are favored with the following reply: — "Newspaper science is rarely worth serious attention, but as the 'Era,' a publication of an institution of learning, notices a supposed new species of bird which, it appears, is named by the President of the University, although described by another gentleman, I suppose the article must be recognized, to the extent at least of blaming it for introducing a new synonym of the ruffed grouse. It is such a complete fiasco, and at the same time is written with such ingenuousness, that I cannot do what you ask and spare the writer's feelings too. I must say that not one of the 'striking differences' that Mr. Jaycox thinks 'are sufficient to characterize a new species and perhaps a new genus,' are of the slightest consequence. *Bonasa umbellus* usually has eighteen tail feathers, but is also found with sixteen, as well as

twenty, as in this instance. The alleged difference in proportions of tarsus and middle toe is within the ordinary range of individual variation; while the points of color adduced may be matched in almost any game bag — indeed, I do not see how the writer ever discovered them, intent as he says he was on the edible qualities of the bird, to which he had better have confined his investigations. He is not to blame, of course, for knowing nothing of ornithology, but he ought not to have rushed into print on the subject, when any ornithologist would willingly have examined his specimen for him, and kept him out of a scrape. If you think this bears down too hard on the writer, ease it up a little; but I really think that Mr. Jaycox will in the course of time thank you for printing it; I remember that just such raps did some of my early lucubrations good."

Albinism and Melanism. — In the November number of the Naturalist is an article on a "Singular Albino," an "albino bobolink" (*Dolichonyx oryzivorus*) "illustrating a rare and curious condition," being "of a uniform pale yellow, exactly like a canary bird."

I would like to ask the writer or any of the readers of the Naturalist if they have ever seen an albino bobolink marked otherwise. I have one taken in this vicinity which perfectly answers to the description given above. It looks precisely like a yellow canary with the exception of size and pointed tail feathers. The remark is frequently made by those visiting my collection, "what a large canary that is." This is the only albino bobolink that I have seen, and it may be unusually marked, yet the description in the Naturalist so exactly corresponds to the one in my cabinet, that the thought occurs to me that this perhaps may be the usual color of the albino of this species. Although albino signifies white, yet there may be various shades of white. I find this statement verified in my own collection. Before me is an albino mink (*Putorius bison*), muskrat (*Fiber Zibethicus*), two wharf rats (*Mus decumanus*), two house mice (*Mus musculus*), pure white, and also an albino red squirrel (*Sciurus Hudsonius*), meadow mouse (*Arvicola riparius*), blue-bird (*Sialia sialis*), two robins (*Turdus migratorius*), barn swallow (*Hirundo horreorum*), cliff swallow (*Hirundo lunifrons*), white, but not pure white. They are more of a dingy white. In the bobolink described above, it might be called yellowish white. In the albino the eye is always red.

Albinism is much more common than melanism — the latter is seldom found. In my collection of about two thousand specimens of birds and animals (one thousand mounted) there is but one specimen of melanism, a black woodchuck (*Arctomys monax*). — Wm. Wood, M.D., *East Windsor Hill, Conn.*

Dredgings in the Gulf of St. Lawrence. — Mr. J. F. Whiteaves has during the past summer, according to "Nature," dredged in from fifty to two hundred and fifty fathoms in the Gulf of St. Lawrence. At a depth of one hundred and sixty and two hundred fathoms a number of sea pens (*Pennatulæ*) were dredged, this genus not having previously been found on the Atlantic coast of America. A Spatangus also occurred; and the following shells, which are new or very rare on this side of the Atlantic: — *Pecten Grönlandicus* Chemn. not Sowb., *Arca pectunculoides* Sacchi. *Yoldia lucida* Lovèn, *Y. frigida* Torell, *Neæra arctica* Sars, *N. obesa* Lovèn, *Dentalium abyssorum* Sars, *Siphonodentalium vitreum* Sars, *Eulima stenostoma* Jeffreys, *Bela Trevelyana*, *Chrysodomus* (Sipho) *Sarsii*, and *C. Spitzbergensis*, the latter shell occurring in shoal water.

The Origin of Insects. — At a meeting of the Linnæan Society of London held on November 2d, Sir John Lubbock, Bart., F.R.S., read a paper on this subject, which has always presented one of the most difficult problems to the Darwinian theory. There is great difficulty in conceiving by what process of natural selection an insect with a suctorial mouth like a gnat or a butterfly could be developed from a powerful mandibulate type like the Orthoptera, or even the Neuroptera. M. Brauer has recently suggested that the interesting genus Campodea is, of all known existing forms, that which most nearly resembles the parent insect stock, from which are descended, not only the most closely allied Collembola and Thysanura, but all the other great orders of insects. In these insects we have a type of animal closely resembling certain larvæ, which occurs in both the mandibulate and suctorial series of insects, and which possesses a mouth neither distinctly mandibulate nor distinctly suctorial, but constituted as a peculiar type, capable of modification in either direction by gradual changes, without loss of utility. The complete metamorphosis of the Lepidoptera, Coleoptera and Diptera, will then be the result of adaptive changes brought about through a long series of generations. — A. W. B.

CHANGE IN THE HABITS OF A BIRD.—The New Zealand papers state that in certain districts in those islands the sheep are being constantly attacked by the Kea or "mountain parrot" (*Nestor notabilis*), belonging to the family of Trichoglossina or Brush-tongued parrots, which infests the neighborhood. These birds are seen sticking to a sheep and pecking at it producing a patch of raw flesh on the loin about the size of a man's hand, from which matter continually runs down the side, taking the wool completely off that part which it touches, and in many cases causing death. The fact is of interest, as affording an instance of entire change of habit within a comparatively recent period. The Kea, like other birds of the family to which it belongs, was originally a fruit-eater, or occasionally feeding on insects concealed in the crevices of bark and rocks. It is only since the colonization of New Zealand by Europeans that sheep or other large mammals have been introduced. The parrots are also frequently seen tearing at the skins of sheep which have been hung up to dry, and they were probably first tempted by these when their natural food ran short in the winter.—A. W. B.

REPRODUCTION OF STURGEON.—The following observations on the sturgeon of the Volga by Professor Owsjannikow and others are recorded in the "Bulletin of the Acclimatization Society" of Paris. The sterlet (*Acipenser ruthenus*), the smallest of the Russian sturgeons, spawns in the Volga early in May on rocky bottoms, the temperature of the water being at 10° R. ($= 54\frac{1}{2}$° F.). The eggs are readily fecundated by the artificial method. After they have been in the water a few minutes they adhere to any object which they touch. The development of the embryo can be observed in progress at the end of one hour. On the seventh day they hatch. At first the young fish are $0^m.007$ (about $\frac{27}{100}$ inch) long. At the age of ten weeks they are nearly two inches long. They feed on larvæ of insects, taking them from the bottom. Both in the egg and when newly hatched, the sterlet has been taken a five days' journey from the Volga to Western Russia, and in 1870 a lot of the eggs were carried to England to stock the river Leith. This species passes its whole life in fresh water. The other species inhabiting the Baltic, *Acipenser sturio*, *A. Huso*, *A. stellatus* and *A. Güldenstädtii*, are anadromous. These species hybridize, and freely, and from this circumstance some Russian savants have pronounced them only varieties instead of species.—C. G. A.

Partial Development of Eggs without Fertilization.—Hensen has observed that the eggs of rabbits, unimpregnated and within closed cysts, developed themselves into polynucleated protoplasmatic masses and fibres. Kupffer also noticed that in Ascidia there arises in the egg before impregnation a peripheral layer of cells which, later on, after impregnation, becomes the external covering of the animal. More recently, as we learn from the "Quarterly Journal of Microscopy", Œllacher has observed the remarkable fact that even in warm blooded vertebrata the first act of embryonic development, namely, segmentation, may take place independently of impregnation.

Flora and Fauna of the Azores.—The most striking fact brought out by Godman's "Natural History of the Azores, or Western Islands," is the wonderful amount of similarity between the productions of these remote islands and those of Europe; from eighty to ninety per cent. of the birds, butterflies, beetles and plants being absolutely identical with common European species, while from one to four per cent. only are American. This is the more remarkable when we turn to physical maps for information and find that both the oceanic and aërial currents are from the westward, so that we should naturally expect the American element of the fauna and flora to be much better represented. The difficulty, however, is to a great extent cleared up by Mr. Godman's observation that the Azores lie in a region of storms from all points of the compass; and that every year these storms bring numbers of birds from Europe, and no doubt also numbers of insects, although these are not so easily observed. We can thus account for the enormous preponderance of European species; and this, taken in conjunction with the entire absence of indigenous Mammalia and Reptiles, causes our author to reject the theory of a common continental extension uniting these islands to Europe as the origin of their fauna and flora. Had this been so, and taking into consideration the vast time implied by the descent of a thousand miles of country to the depth of fifteen thousand feet, we should certainly have found the productions of the Azores to be far more endemic and peculiar than those of Madeira and the Canaries, instead of far less so.

The most curious and difficult problem is presented by the existence of a considerable number of wingless beetles of genera peculiar to the Atlantic islands (Azores, Madeira, Canaries). These

could not possibly, in their present condition, have been transported over the six hundred miles of ocean that now intervene between these groups. Mr. Wollaston has, however, discovered that beetles have a tendency to become apterous in these islands; many which are winged in Europe, or belong to winged genera, being altogether wingless in Madeira and the Canaries. Some of these wingless species differ in no other respect from their European allies, so that we may be sure the change has been effected in a comparatively limited time; and the fact that some European species possess both winged and wingless individuals shows that the character is an unstable one, and therefore easily abolished or retained as one or the other state becomes advantageous to the species. We are thus at liberty to suppose that these wingless Atlantic groups are the descendants of very remote winged ancestors, who were among the earliest immigrants to all these islands; and these being subjected to similar conditions, all became apterous. Another strange phenomenon is presented by the *Elastrus dolosus*, a beetle of the family Elateridæ which belongs to a genus peculiar to Madagascar. A single plant, *Myrsine Africana*, a native of tropical Africa and the Cape of Good Hope, is found in no other group but the Azores where it seems to be common. As another beetle of the same family (Elateridæ) is allied to a Brazilian species and is therefore probably the descendant of an ancestor who came over in a floating log, we are led to speculate on the possibility of this anomalous Madagascar beetle and S. African plant having been introduced by a similar process; since the currents round the southern extremity of Africa partially merge into the great equatorial current of the Atlantic which gives rise to the Gulf Stream, and this undoubtedly reaches the Azores.

Mr. Godman had previously visited the Galapagos Islands, which are only half as far from South America as the Azores are from Europe, yet they contain hardly any identical species of birds, plants or insects. This is well explained by the fact that these islands are situated in a region of calms instead of one of storms; and chance introductions being therefore a far rarer occurrence, the early immigrants have all become modified, and have so stocked the country with their peculiar and well adapted forms that new comers (if any do come) have little chance of establishing themselves.—ALFRED R. WALLACE, *in the Academy*.

Circulation in Insects.— Mr. H. N. Moseley finds the circulation of insects to be observed most advantageously in the wings of *Blatta orientalis*. The details and results of his methods of observation are given in the "Quarterly Journal of Microscopical Science." When *B. orientalis* casts its skin it emerges quite soft and milk-white: at which time light may be thrown through the body, and the action of the heart and valves studied to advantage. The circulatory system of insects is injected with difficulty from the heart: a more certain result is obtained by cutting off half of one wing and injecting, through the cut edges, either the removed portion of the wing, or the remaining portion and through it the heart. Indigo-carmine, or Berlin blue solution, is preferred as the injecting fluid. Mr. Moseley places the fluid in a short india-rubber tube closed at one end and furnished with a canula at the other, and forces it into the insect's veins by pressure of the finger upon the tube; a procedure which would seem to be applicable to many other cases. — R. H. W.

GEOLOGY.

The Chantauqua Mastodon. — The remains of a skeleton, belonging to the extinct species of animal, *Mastodon giganteus*, were discovered the twenty-fifth of August, 1871, in the vicinity of Jamestown, N. Y. These remains were found imbedded four feet below the surface, in soil composed of peat and marl, and deposited in the Post-tertiary period; and were located in a swamp, two acres in extent, situated upon a farm now owned by J. E. Hoyt, formerly known as the Reynolds place, about one mile north of the village of Jamestown. This small swamp, fed by springs, had been drained five years ago, and last August workmen were excavating the muck, scattering it upon a four-acre field, when they finally came to the tusks estimated to be *twelve* feet in length before they were much disturbed or broken. They found also, in proximity to the visceral cavity of the larger skeleton, a mass of undigested food, some eight or nine bushels in quantity, and consisting of slightly decayed twigs, of two or three inches in length, identified as cone-bearing species, similar to our pines and firs, and remarkably preserved.

At the time of my visit, upon the 16th of September, the remains were deposited mainly in the cabinet of the "Union School

and College Institute." I also found a portion of the bones, particularly those of the smaller animal, at the residence of Prof. S. G. Love, to whom I am much indebted for information bearing upon the subject.

The left side of the lower jaw, preserved almost entire, was two feet in length; and the size of cranium, from sections observed, was some three and a half feet in length. The depth of the jaw bone was seven and a half inches; its width six inches. There were two fragments of one tusk; the point, three feet and seven inches in length, six inches in width, with marked depressions upon one side of surface; the other fragment, two feet five inches in length, seven and a half inches in diameter and much decayed; an intermediate section and the one adjoining the cranium were gone. There were six teeth; larger ones seven and a half inches in length, weight five and a half pounds, with mammillated eminences (distinguishing the species), of about two inches in elevation. The enamel was well preserved. Sections of scapular were thirteen inches long, seven inches wide; fragments of ribs, twelve to eighteen inches in length. A section of the ribs, as first found, was five feet in length. Head of femur bone was also here.—I should judge the height of the larger skeleton to be fifteen feet, its length seventeen or eighteen feet.

The smaller skeleton (found at a short distance from the larger one), was probably seven feet in height; tusks four feet long, four inches wide; teeth three and half inches in length; sections of jaw and rib bones were also found.—T. A. Cheney, *Leon, N. Y., Nov.* 13, 1871.

A New Fossil Butterfly.—Mr. S. H. Scudder has discovered a new species (and genus) of butterfly from Aix which is contained in the museum at Marseilles. He calls it *Satyrites Reynesii*, after the direction of the museum. The specimen consists mainly of the two forewings, the venation of which can be made out very satisfactorily. It is of the form, and has the general appearance, of Portlandia, though nearest to the East Indian Debis.

ANTHROPOLOGY.

Flathead Indians.—I will give you now a short outline of the religious traditions of the Flatheads, comprising also their notions about the globe, etc.

The earth, according to them, is not spheroidal but flat, and surrounded with water on all sides, like an island, and heaven or sky is nothing else than a huge hollow mountain, covering the earth, as the covering of a kettle. Before the creation, *Skòmelten* (obsolete word, meaning mother, and which was substituted by the word *Skói*), a woman very powerful, and who took existence by herself, begot a son without assistance of man, and this son undertook to create heaven, and earth, and man; and for his dwelling he chose the summit of the covering, namely, heaven, whence he took the name of *Amòtkan*, which means, *He who sits on the tops of the mountains;* while Skòmelten, his mother, remained above on another land beyond the waters; for besides our earth, they thought that *Amòtkan* created other worlds, under, above and around us.

This *Amòtkan* was then considered as their invisible God, who has also many sons, though no wife; and when the Indians saw the whites for the first time, they considered them to be the natural sons of *Amòtkan*, and consequently immortal, until they saw one of them killed by the Blackfeet.

The first generation of mankind became very wicked, and turned a deaf ear to the admonitions of *Amòtkan*, who, in his wrath, drowned them all in a general inundation. *Amòtkan* undertook a second creation of a race of people, twice as tall as the first ones; but proving worse than the first, they were all destroyed by fire which came from heaven. The third generation being as bad as the first and second, was destroyed by *Amòtkan* through a general pestilence. The fourth generation would all have been annihilated on account of their crimes, had not mother *Skòmelten* interceded with her son in behalf of mankind. The wrath of *Amòtkan* was appeased by the prayers of his mother, and he promised never to destroy his creations again. But until that time the world was in perfect darkness, there being no sun; and the people being persuaded that the darkness was the cause of their wickedness, they held a general council for the purpose of enlightening the world; but as every one refused, *Sinchlèp* (a small prairie-wolf), being the smartest of all the animals, undertook and succeeded in lighting the world very little less than the actual sun, and the people were very glad. But the animals of those times had the power of speaking, no less than the people, and *Sinchlèp*, being very cunning, interfered too much in their secret business, and in pass-

ing by during the day published the actions which the people performed in secret; wherefore, in anger, the people took *Sinchlèp* by the tail, which at that time was very long, and fastening him to the ground, prevented his being seen any more. The crow then offered himself in place of *Sinchlèp*, but, being naturally so very black, gave little light, and, unable to endure the ridicule of the people, he retired with shame.

Finally *Amòtkan* sent one of his sons, called *Spakaní*, to enlighten the world. Before doing so, *Spakaní* wished to marry with a woman of the earth. In coming down from heaven, he landed first in the camp of the Flatheads; but the people seeing him, though very handsome, but so different from themselves, refused him admittance to their lodges. *Spakaní*, very much displeased, left the place, and seeing near the village a small cottage, inhabited by a family of frogs, he went in, complained of the people, and showed his desire to marry one of the frogs. There was one, very large and fat, and thought herself very happy to become the wife of the son of *Amòtkan*, and with one jump she became one flesh or incarnated with the cheek of *Spakaní*, and thus matrimony was celebrated or consummated. The people, on seeing the cheek of *Spakaní* so disfigured, and enraged at the presumption of Mistress Frog, tried with sticks to kill her, until the frog, very much ashamed, prayed her husband to leave the earth; and since he had come to make himself sun, to go up immediately, which he did; but to revenge himself for the contempt of the people, he does not allow them to see him clearly during the day, when he covers himself with a shining robe, and at the approach of night, he deposits his robe, crosses the waters under the earth, and then only shows himself as he is, with his wife frog on his cheek.

For these Indians, the sun and moon are one and the same thing; and this notion accounts for the reason why they have but one and the same word to express both sun and moon, namely, *spakaní;* and so also the spots in the moon are nothing else than a frog.

Having heard this story, I asked them (there were several chiefs among those present) whether they really believed the fable; and they answered that they did, not knowing better; then I asked them what they thought when they saw the sun and moon at the same time during the day. They all started, looked at one another in surprise, looked up, as though searching the sun and moon, then

joined in a general laugh, and covered their faces as if ashamed; and one of them, looking at me with only one eye across his fingers, said, "Well, we were all beasts, and like enough not one of us has ever observed and remarked what you say now." Since that time it was agreed to call the moon by the name of *spakaní skukuèz*, meaning the *sun of the night*.

As to the immortality of the soul, the end of the world, the recompense or punishment after death, they have the tradition that man in dying, dies only half—that is, the body; the other half (which they anciently did not know how to designate, but which afterward their ancestors called *Singapèns*) does not die, but the singapèns of the good ones go to stay with Amòtkan: though without knowing to what particular bliss, and the *Singapèns* of the wicked go to another place, not determined, having no other punishment than to be deprived of the company of *Amòtkan*. For wicked they intend liars and thieves, as they consider lying and theft, if not the exclusive, at least the greatest sins. Moreover, they said that the earth and the people have one day to come to an end, and that after this last day all the dead shall come to light again, and shall be placed in another land, better than the present, and that after such epoch the people shall die no more.

Notwithstanding the power and nobility of Amòtkan and Skòmelten, these were not the deities which the Flatheads worshipped, but Spakaní, the sun. After him came as geniuses the animals of every kind, the beaver, the crow, the deer, etc. But *Sinchlèp*, the prairie-wolf, was regarded the most powerful and favorable to mankind. To show the power and favor of *Sinchlèp*, their ancestors reported that there was a time when a large portion of the earth was inhabited by a set of giants, terrible men, who killed every one they met with, for which they were called *Natliskèliguten*, which in ancient language means "killers of men;" that *Sinchlèp*, in pity for the smaller people, went through all the earth, killed every giant, and converted them all into large stones; and even of late, when the Flatheads in crossing the mountains saw a basaltic stone standing upright, they said to one another, "*Keep aside, there is a Natliskèliguten killed by Sinchlèp;*" and every large piece of silex they saw, was for them a fragment of an arrow of the "killers of men." As it oftentimes happens that one or more of these prairie-wolves come at night to howl near the village, there are still many, particularly the old women, who believe

that *Sinchlép's* howling foretells the arrival by the next day of somebody, either friend or foe, provided he only howls three times.

The worship which our Indians rendered to the sun, consisted in raising up towards the sun a morsel of meat or roots before eating them, and saying, "Sun, have pity of us, that animals and fruits may grow abundantly." In their particular distresses each one prayed to whatever first met his eyes, whether a tree or a stone.

In worshipping the sun, our Indians were not as fervent as the Blackfeet are even now; who, not satisfied with offering a parcel of their food, very often cut off large pieces of flesh from their bodies and offer them to their *Natósa* (the sun), particularly when they go to war. I asked an old man, well nigh a hundred years of age, if he prayed when he was young, and how he prayed. "Oh! yes," he answered, "every morning my mother took me into the woods, and having found a dry pine-tree, broken and rotten from old age, she told me, 'My son, go and rub yourself against that tree, and pray.' And so I did, saying, 'O my good tree! have pity of me, and let me live as long as you have lived;' and I repeated always the same prayer; my mother did the same at another tree not far from mine, until our sore shoulders compelled us to put an end to our prayers."

Generally the prayers of our Indians consisted in asking to live a long time, to kill plenty of animals and enemies, and to steal the greatest number of horses possible; and this was the only instance when to steal was not a fault, but a great merit and bravery, since no man could ever hope to become a chief unless he had killed at least seven Blackfeet, and stolen twelve horses.

As it happens rather often that both people and animals are killed by lightning, so they regarded it as an evil genius; and the rainbow was for them nothing else than the same lightning looking down for prey amongst the people; they believed that the only means to avoid being killed, was to move off immediately and to go and encamp at some miles' distance.

NOTE.—The above is from a letter of Father Mengarini to Geo. Gibbs, Esq.; though written some years ago, it is published for the first time in the "Journal of the Anthropological Institute of New York," Vol. i, p. 81, 1871.

Mr. Gibbs states that the frog-wife story exists in a modified form among the Nisquallies and other tribes also, as does much of the remaining mythology of the Rocky Mountains Flatheads. It is noticeable that the Mexicans, according to Garva, quoted by

Gallatin ("Trans. Am. Ethn. Soc.," vol. i, p. 97), believed in the destruction of the world four times by various causes, on each occasion of which the sun also perished, so that the present is the fifth sun.

MICROSCOPY.

Gases and Vapors in Micro-chemistry.—Mr. E. Ray Lankester describes in the "Quarterly Journal of Microscopical Science" his gas-chamber, which is a modification of the one used by Schweigger-Seidel. A watch-glass-shaped piece of glass has its edges ground and cemented to a flat plate of glass. The top of the dome thus formed is ground away so as to make a large opening into its cavity, and closed by a thin cover glass which bears the object to be examined upon its under surface and therefore inside of the cavity of the dome. This covering glass is held in position, and the joint rendered air-tight, by means of oil. Into the top and sides of the dome are inserted glass tubes, three in number, through which re-agents, in the form of gas or vapor, are introduced into the dome by means of suction or of pressure. To prevent too rapid drying of the object, as a drop of blood, the gas may in some cases be previously passed through warm water in a Wolff's bottle. Heat may be applied by introducing one end of a stout copper wire through one of the tubes, and heating the end which remains outside, or by similarly introducing a platinum wire connected with the poles of a galvanic battery. In this manner liquids may be vaporized inside of the dome, if desired.

Among the re-agents thus used are water, hydrochloric acid gas, carbonic acid gas, acetic and osmic acids, nitrogen tetroxide, hydrogen sulphide, chlorine, iodine, bromine, ammonia, alcohol, ether, chloroform, carbon bisulphide and carbolic acid.

The advantages claimed for gaseous re-agents are, that some can be used in no other state, that they are applied without a deluging stream which might displace the particles under observation, that the action of diluents (as water or alcohol) is avoided, and that minute traces of the re-agent may be introduced, increased, stopped or counteracted with great facility. The author believes that in chemical histology all re-agents should be applied in the gaseous form, though not exclusively so, if possible.

Microphotography.—A good popular article on this subject is published by Mr. Charles Stodder in the "Boston Journal of

Chemistry." The history and advantages of microscopical photography are well given, though no reference is made to the corresponding disadvantages, such as the unequal applicability of the process to objects of different colors, and the necessity of representing a single focal plane or section of the object, while the different varieties of delineation by hand-work enable the artist, if sufficiently expert to know what he sees, and sufficiently candid to draw what he sees and not what he thinks he ought to see, to reconstruct to some extent the object and represent at a single view the knowledge gained by many slight changes of focus. Unfortunately for their value as tests in this case, the so-called test-objects seem to be particularly suitable for photographic illustration. Of the Woodward photographs familiar to the writer, those of the test-objects are (probably necessarily) more faultless than those of the tissues, and are therefore tests of the corrections of the objectives and of the perfection of the illumination rather than of the general applicability of the photographic process. Of this latter question, but little understood as yet, the researches of Dr. Woodward and others give promise of an early solution.

Mr. Stodder applies the name of microphotograph to the enlarged photographic representation of a microscopic object, such as the well-known productions of Dr. Woodward and of Dr. Maddox, although, since that name was previously appropriated to the reduced photographs for microscopical inspection taken from large objects, some microscopists have recently preferred, for the sake of distinction, to designate the enlarged photographs of small objects by the name of photomicrographs.

Curious Varieties of the Liber. — "The Lace Bark of Jamaica (*Lagetta lintearia*), is composed of a series of concentric layers of very fine and strong fibres, which, by crossing and interlacing each other, form a complete network, the beauties of which are quite hidden till the bark is beaten out, and the fibres partially separated by carefully pulling them in a lateral direction, when a piece of vegetable lace a yard or more in width, will be produced. This natural lace is used in Jamaica for making ats, caps, collars, frills, etc. . . . . The bark of the Paper Mulberry of the South Sea Islands is another of the fibrous kinds; it is very strong and tough, and is used in the Pacific Islands for making what is called tapa cloth, which serves the natives for

various articles of clothing. Another remarkable fibrous bark is the *Antiaris saccidora*, called the Sack Tree in Western India and Ceylon. The bark of this tree is used for making sacs, hence its common name. A trunk is selected of the requisite diameter, and a piece is cut off, of the required length; the bark is then soaked and beaten, loosened from the wood, and turned back or inside out; if it is entirely stripped off, it requires simply to be sewn up at one end, but it is usual to leave a small piece of the wood to form the bottom. The bark is toughly fibrous in the Stringy Bark Tree (*Eucalyptus gigantea*) of Tasmania: while in the Iron Bark it is tough and might be taken for a close-grained wood. The ashes of the bark of the Pottery Tree of Para, whose cells are shown by the microscope to be silicated, is mixed with clay by the Indians, and made into a kind of earthenware which is very useful and durable."—MR. JACKSON, *of the Kew Museum*. From the *Monthly Microscopical Journal.*

LEPIDOPTEROUS SCALES.—Chevalier Huyttens de Cerbecq of Brussels, after careful study of the scales of butterflies and moths, with immersion objectives and transparent illumination of high powers by the paraboloid, is satisfied of the beaded structure of the scales of most insects, if not of all.

Dr. John Anthony describes the markings on the ribs of the "battledore" butterfly-scales as consisting of heads or knobs elevated on stalks. In his plates in the "Monthly Micoscropical Journal" they stand up like door-knobs or like the glandular hairs on some plants. He uses light reflected from a rectangular pri a carefully centred, and limited by the diaphragm; and as the appearances are well seen with objectives as low as one-fifth inch, he judges that they will be readily seen by other observers.

GRINDING DIAMOND POINTS.—Mr. F. H. Wenham, with his accustomed liberality which the world will not soon forget, publishes in the "Monthly Microscopical Journal" the method by which a fragment of diamond may be turned in a lathe to a point as fine as a needle. These points are easily prepared, and are the right thing for glass ruling, being used in Peter's writing machine, and probably by Nobert. A splinter of diamond is mounted on the end of a wire, chucked in a bow-lathe, and turned against another splinter similarly mounted. The importance of this suggestion may be inferred from the fact that Mr. Stanistreet, whose machine

was calculated to rule lines to the $\frac{1}{100,000}$ of an inch could not procure any diamond fine enough to rule more than about five thousand to the inch.

VITALITY AS AFFECTED BY TEMPERATURE.—Mr. Grace Calvert found that 300° and sometimes 400° Fahr. are sometimes required to destroy living germs; also that animalcules could live for hours at seventeen degrees below the freezing point of water.

MICROSCOPICAL MANIPULATIONS.—Mr. Stanistreet justly judges that other amateurs will be encouraged by learning that the machinery for ruling his already famous lines was entirely constructed by himself, untaught and unassisted, while confined to the house by illness.

FIBRES OF FLAX AND HEMP.—Mr. Suffolk states that a committee, on which he was appointed by the Queckett Club, undertook the study of these fibres with reference to their discrimination with the microscope in mixed fabrics; but abandoned the work on finding the fibres too much alike to be distinguished.

DARWINISM AND HISTOLOGY.—Dr. Lionel Beale, in his address to the Queckett club, counsels a careful comparative study of the tissues of man and the apes, in order to verify, if possible, the correspondence which has been asserted but not proved to exist between them.

STAINING AND CUTTING LEAVES.—Dr. R. Braithwaite, in his elaborate study of the bog-mosses, stains leaves by immersion from two to twenty-four hours in iodine and sulphuric acid or a solution of biniodide of zinc, preferably the latter. Transverse sections he obtained by soaking the leaves in thick mucilage of gum arabic, and, when partially dried, enclosing between pieces of elder pith and slicing into water.

ALTERNATION OF GENERATIONS IN FUNGI.—Mr. M. C. Cooke reviews, in "Nature," the experiments of Oersted and of De Bary on this subject. Most Uredines have two forms of fruit, but it is exceedingly difficult to prove an alternation of generations in any case. When the spores of fungi are sewn upon a plant, or introduced by inoculation, it is nearly impossible to prove that other fungi subsequently appearing on the same plant owe their presence there to the spores intentionally sewn or inoculated.

Preservation of Fresh-water Polyzoa.—Mr. Stewart explained to the South London Microscopical and Natural History Club that he had succeeded in killing polyzoa with the tentacles expanded by adding a few drops of the best French brandy to the water they were living in. They were overcome by the liquor, without drawing in their plumes.

Crystallization of Metals by Electricity.—This has been studied under the Microscope by Philip Braham, Esq. His apparatus is described in the "Monthly Microscopical Journal," for Dec. 1871.

Conjugation in Rhizopods.—J. G. Tatem, Esq. has observed what seems to be an instance of this hitherto unnoticed, though not unsuspected, process in the case of a common Amœba.

Photographing by Black-ground Illumination.—Dr. Woodward has obtained good high-power photographs (x 1000) of objects illuminated by Mr. Wenham's truncated lens.

Cleaning Diatoms.—Dr. Maddox cleans and bleaches diatoms by immersion in a solution of chlorate of potash and hydrochloric acid.

Microscopical Structure of the Wax or Bloom of Plants.—An interesting study of this familiar substance occurring on leaves and fruits, by Prof. De Bary, is given in the "Botanical Zeitung," with some thirty beautiful illustrations. The wax does not appear to be a simple coating over the surface, as though it might have been laid on liquid with a brush, forming a continuous layer. It is seen to be rather a dense forest of minute hairs of wax; each one sitting with one end upon the epidermis and the other either rising up straight or rolled and curled among its neighbors. This matting of waxen hairs often becomes so dense that when examined from the surface it presents to the microscope the appearance of a continuous layer, while a carefully made section of the leaf, or skin of the fruit, shows its true structure. The question from what part of the epidermis or subepidermal tissue does the wax come, is most beautifully and clearly answered. He says that in the cell-contents there cannot be discovered the slightest trace of wax, and the statement that the chlorophyll is partly made of wax is totally erroneous. The locality

in which it can be first detected is the cuticle and the cuticularized elements of the epidermis cells.—T. D. B.

NOTES.

Prof. Agassiz read a notice of the life and character of Dr. E. Holbrook of Charleston, S. C., before the Natural History Society of Boston, Oct. 18, 1871. He remarked that:—

"The death of Dr. Holbrook has been deeply felt by a very large circle of friends, and by those who are acquainted with the history of science during the last fifty years. But highly as he was appreciated by all to whom he was personally known, and by his scientific peers and colleagues, America does not know what she has lost in him, nor what she owed to him. A man of singularly modest nature, eluding rather than courting notice, he nevertheless first compelled European recognization of American science by the accuracy and originality of his investigations. I well remember the impression made in Europe more than five and thirty years ago, by his work on North American reptiles. Before then, the supercilious English question, so effectually answered since, 'Who reads an American book?' might have been repeated in another form, 'Who ever saw an American Scientific Work?' But Holbrook's elaborate history of American Herpetology was far above any previous work on the same subject. In that branch of investigation Europe had at that time nothing which could compare with it.

Born near the close of the last century, in 1796, Dr. Holbrook entered upon his career as a student at a moment of unusual activity in scientific research in Europe. Although his birth occurred at Beaufort, S. C., he received his early education at the north. His father, himself a New England man, brought him, when only a few months' old, to Wrentham, Mass. There he grew up, and though his after fortunes led him back to his birthplace and the greater part of his life was passed in South Carolina, he remained warmly attached to the home of his boyhood. From school he went to Brown University, and after completing his college course there he studied medicine in Philadelphia, and subsequently practised for a short time with a physician in Boston; but he took a larger and more comprehensive view of his profession than that of the special practitioner, and he went abroad to seek a more general scientific culture. He went through the Medical School at Edinburg, and then travelled on the continent, making himself familiar with methods of study and practice there. But perhaps nothing in all his European journey had greater influence upon his future life than his stay in Paris, where he worked at the Jardin des Plantes, and became intimate with some of the leading scientific men of the day. He formed relations then which ended only with

life, such as his friendship with Valenciennes, with Dumeril, Bibron and others.

On his return to America he was called to the Professorship of Anatomy in the Medical School of Charleston, S. C. From this time Dr. Holbrook, although he became an eminent practitioner in the city which had adopted him, was even more distinguished as a teacher of human anatomy, and finally renounced practice to devote himself to his professorship. Clear, simple and straightforward as a teacher, intimate with the most advanced systems of thought and instruction, he inspired his students with a love of nature, and made them indeed, in not a few instances, naturalists and men of science, as well as physicians. His pupils are among the most cultivated men of the South. His lovable personal qualities endeared him to them, and many of his students lost in him not only a revered teacher, but a well beloved friend."

The Officers of the Boston Young Men's Christian Union, recognizing the importance of scientific studies, and the need of encouraging scientific tastes, have determined to establish in the rooms of the Union a Natural History cabinet. Their object in providing such a collection, is to foster the growing taste for science among the young men of Boston, and to open a new source of instruction and amusement to the members of the Union.

The cabinet will be in charge of Mr. F. W. Clarke, and contributions to start it are earnestly solicited. Specimens should be sent, carefully packed, to the care of F. W. Clarke, B. Y. M. C. Union, 300 Washington Street.

In compliance with a repeatedly expressed desire, the Smithsonian Institution has determined to make more frequent transmissions to Europe of exchanges of books, and announces that it is prepared to receive parcels at any time, with assurance of speedy delivery, at least to the more important addresses, upon the following conditions, which must be strictly observed:

1. Every package, without exception, must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.
2. The address of the institution or individual for whom the the parcel is intended must be written legibly on the package, and the name of the sender must be written in one corner.
3. No single package must exceed the half of a cubic foot in bulk.
4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.
5. No letter or other communication can be allowed in the par-

cel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

Unless all these conditions are complied with the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

Specimens of natural history will not be received for transmission, unless with a previous understanding as to their character and bulk.

Our contemporary, the "Revue Scientifique" (Jan. 13, 1872, p. 679) in analyzing a paper by one of the editors of this journal, has made several mistakes, one of which we might notice. It says "Mr. Packard rejects in consequence the idea of Fritz Müller and Brauer that the primitive insects had all leptiform larvæ, and were not afterwards modified to produce insects with eruciform larvæ." On the contrary he agrees with the opinion of Müller and Brauer that the earliest insects were those with an incomplete metamorphosis, quoting with approval Müller's note to that effect.

In a previous number (Sept. 23, 1871, p. 300) Dr. Packard is made to say "that the king crabs are nearer the Trilobites than Pterygotus." He has never said this, but on the contrary follows Mr. Woodward in uniting the king crabs with the Eurypterida, of which Pterygotus is a member; considering the king crabs as on the whole much more remotely allied to the Trilobites than to the Eurypterida.

Entomologists will be pleased to learn that Mr. R. H. Stretch of San Francisco is now ready to begin the publication of "Illustrations of North American Zygænidæ and Bombycidæ" in which he hopes to be able to figure all the North American species. The first plate, containing eight species of Alypia, six of Ctenucha, one Scepsis and a Psychomorpha are in the hands of Miss Peart of Philadelphia to be lithographed. Mr. Stretch proposes to figure the species as he can procure them, and so to arrange the letter press that it can be bound in proper order. The book will be uniform in size with the transactions of the American Entomological Society. The value of such a work will largely depend on the aid rendered to Mr. Stretch by museums and individuals, and

we trust he will receive every encouragement. At any rate many interesting and rare Californian species will be figured, which will make the work of much value to students.

THE second edition of the "Guide to the Study of Insects" having been exhausted, a new and improved edition will appear late this month. Several new plates and cuts will be added, and an appendix, bringing the work down to the latest date. The price will be reduced to five dollars.

A NATURAL History Society is flourishing at Natick, Mass., and is now growing rapidly, having a membership of seventy. Its museum is gaining accessions, and already needs more room for cases.

IT is proposed to add a department of Science to the Executive Branch of the Government. It is to be composed of the Storm Signal Corps of the army, the Lighthouse Board, and the Coast Survey Bureau of the Treasury, and the Hydrographic Bureau of the Navy.

A COMMUNICATION to the Corporation of Brown University was recently presented from Colonel Stephen T. Olney, making a munificent offer of his herbarium and books on botany, on condition that a suitable building should be provided for their reception. It was referred to a committee.

DR. W. Stimpson writes us from Key West, Florida, under date of January 15, "To-morrow I leave here in the U. S. Steamer, "Bibb" Capt. Robert Platt, to run a series of dredgings between Cape St. Antonio (Cuba) and Cape Catoche (Yucatan), and I anticipate most interesting results, as Capt. Platt has had three years' experience in deep sea dredging with Pourtales. We expect to get into two thousand fathoms at least."

EXCHANGES.

Botanical microscopic objects (mounted) also herbarium specimens of mountain and sea-shore plants, desired in exchange for U. S. herbarium specimens.—REV. H. G. JESUP, *Amherst, Mass.*

Diatomaceous Material, fossil or recent, desired in exchange for mounted diatoms from Western localities.—H. H. BABCOCK, 11 18th *St., Chicago, Ill.*

Azolla and other Hydropterides (living specimens) desired in exchange for fresh water algæ or mounted microscopic objects.—T. D. BISCOE, 321 *George St. Cincinnati Ohio.*

Microscopic Fungi, mounted or unmounted, desired in exchange for microscopic slides or herbarium specimens.— C. E. HANAMAN, 103 *First St., Troy, N. Y.*